PUBLIC WORKS

Dec. 1950

CITY, COUNTY AND STATE

Public Works leaders: Ralph E. Fuhrman, new president of the Federation of Sewage and Industrial Wastes Associations. More data on page 26.

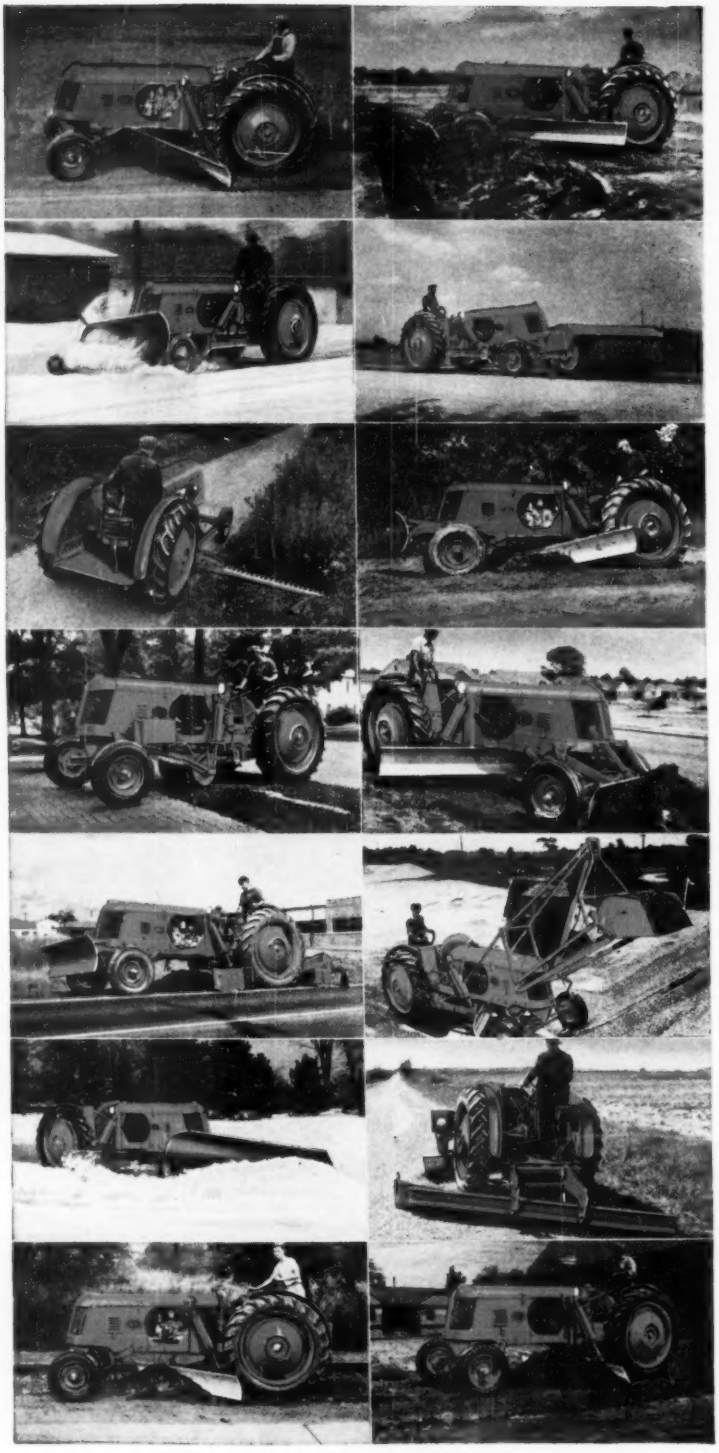
MORE for your MONEY!

Weighs 6000 pounds with liquid in tires
Big 42½ H. P. engine
One-third the cost of a big grader
Hydraulic controls

HUBER MAINTAINER-

9 MAINTENANCE MACHINES IN 1

1. GRADER
2. HIGHWAY MOWER
3. BERM LEVELER
4. ROAD PLANER
5. BULLDOZER
6. LIFT LOADER
7. ONE-WAY BROOM
8. PATCH ROLLER
9. SNOW PLOW



HUBER MFG. COMPANY

MARION, OHIO

See your nearest HUBER Distributor for Maintainers, Rollers and other Road Machinery.

When you need special information—consult READERS' SERVICE DEPT. on pages 93-97.

PUBLIC WORKS
Magazine

Edited by W. A. Hardenbergh and A. Prescott Folwell

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THE EDITOR'S PAGE

To Our Readers for 1951

FOR 1951, we wish our readers a happy and a prosperous year, with greater accomplishments and correspondingly greater satisfaction and advancement in their work. Much has been achieved in the past year, but still more remains to be done. We need more and better highways, water supply, sewerage and waste treatment, refuse, airports and those other facilities which contribute so greatly to our strength and to our better living. We are happy to be a part of a profession that is charged with such important responsibilities and is so capable of discharging them with benefit to all.

Public Works Construction and Critical Materials

USEFUL public works are essential, in peace or in war, and ought to be continued, irrespective of their requirements for critical or near-critical materials. This nation is deficient in highways, in provision for water supplies, and in plants for waste disposal, and this deficiency will constitute just as serious a handicap as any other possible shortage in case of a major emergency.

Steel and Iron Requirements

TO determine how much steel and other ferrous metals are needed for sewage treatment plant construction, PUBLIC WORKS has asked a number of engineers and contractors for information. Some data on this was published in our November issue. In summary, it appears that about 500 tons of ferrous metals are required per million dollars of construction cost, exclusive of the fabricated equipment for treatment. On the same basis, about 95 tons are required per million gallons of plant capacity.

Requirements for water supply and treatment plants are more difficult to determine, for much depends on the amount of pipe involved, and it is not easy to present average overall figures. Considering the average of all types of supplies, such as deep wells, filtration and softening, and chlorinated surface waters, it is not believed that the amount of steel and iron required would be appreciably more than is required for sewage treatment; perhaps not as much.

Highway and street construction, aside from large bridges and viaducts, does not involve large amounts of reinforcing or other steel; some types of road surfaces do not require any steel; and various other substitutions are possible, if wholly necessary, which will reduce steel usage.

Are Ferrous Materials The Only Critical Materials?

THIS question is not an easy one to answer, but it is believed that appreciable amounts of other critical materials are not required for the types of construction indicated above. An overall and hasty examination of the needs for such materials created by a full-scale continuation of construction of useful and needed public works appears to indicate that the amounts of critical materials needed for such a program would be insignificant in comparison with their normal flow into commercial channels.

How About Construction Equipment?

CONSTRUCTION equipment requires steel and perhaps also other material that is or may become critical, but to put any restrictions on manufacturing such equipment would be a blunder of the first magnitude. First, we need more and more equipment to carry on economically our routine and needed construction and maintenance of essential public works; second, a generous stockpile of such equipment—usable even though not new—would be a tremendous asset in an emergency, permitting large scale construction to be carried on without delay and with a high degree of effectiveness; third, if a major emergency should come, manpower will again, as in the past, be our greatest critical material and our most serious shortage. We can multiply our manpower only by wise usage and broad employment of labor-saving equipment, not only in the manufacture of products, but in the construction and maintenance of facilities so necessary in time of emergency.

Our Needs in Public Works

PUBLIC works of the types listed previously, and of other kinds also, are needed now and will be needed in case of emergency. Their construction should be continued because they will

(Please turn to page 10)

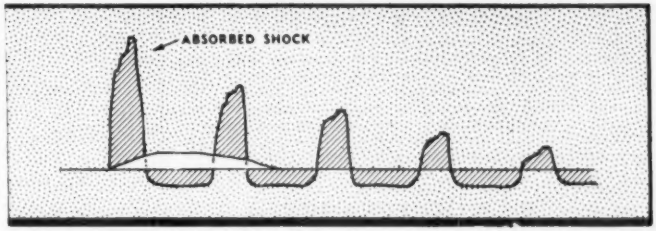
Water Hammer and Pipe Line Surges

CAN BE CONTROLLED WITH

FLUIDYNAMIC DESURGERS

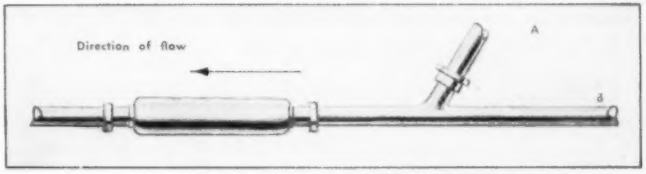
PROTECT PIPES, PUMPS, VALVES BY REMOVING 75% TO 96% OF THE SHOCK PRESSURE.

Here is a new approach to ending difficulties and dangers from water hammer or hydraulic shock. From 75 to 96% of the shock pressure is removed by these time-tested through-flow instruments. Can be applied to any water line close to the origin of the trouble.



White area shows effect of Desurger in reducing water hammer shock and surge in gravity pipe line with quick valve closure.

8-inch Fluidynamic Desurger in main distribution system at Voorheesville area Schenectady, N. Y. Army Depot, showing 6-inch line from principal deep well pump entering 8-inch line from stand-by pump.



A—From deep well pump. B—From standby pump and 8-inch line.

WHAT IT DOES

The Fluidynamic Desurger is available in all nominal pipe sizes. One installation at a quick closing valve protects entire system upstream from that valve. There is no loss of head through use of the Desurger. It affords protection to pipe, pumps, and valves. Eliminates surge at pump station—no pipe vibration. Installation in discharge line from several pumps protects all pumps.

ADVANTAGES

More GPM with same pipe size and power unit. Permits smaller wall thickness of pipe by removing surge strains. Gives higher safety factor. Acts as shock absorber at valve closure. Affords meter protection. Reduces cost of motorized valves.

Engineers are invited to write us at either address below for full information. No obligation, of course.

VEDCO

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EDITORIALS

from page 7

serve the nation equally well in war and in peace, perhaps most in case of the former. Ten years of depression and five years of war created a deficiency which has not been made up and which we should not delay or waste time in repairing.

New Criteria on Federal Planning Advances For Public Works

THE second planning program for non-Federal public works has been redirected (as of late October) to relate it more directly to the defense program. New criteria for governing future advances will be (1) whether projects contribute directly to defense operations; and (2) whether projects meet essential and immediate civilian requirements. Applications now on file in district offices, as well as in the Washington office, will be restudied against these new criteria.

These new requirements were forecast in the editorial appearing on this page of our August issue, which closed with: "facilities which will contribute to the national health and ability to function more efficiently . . . . should not be curtailed."

That Proposed New Deal on Reserve Officers

ON its face, the recent proposition of the Defense Department that reserve officer rolls should be cleared of those officers who, in time of emergency, cannot serve in the armed forces, is attractive. It has many desirable features, but it also brings up a number of problems. For our part, we have never felt that the reserve officers' roster should contain the names of men who, by virtue of government office or special skills, will never be available for service. These men clutter up promotion lists and take up training funds that might better be spent on someone else.

Before going all out for this proposal, though, we would like to know who and what is going to be essential. Our own recollection of essentiality during the recent war was that it had a certain rubbery characteristic—to-day you were essential, and to-morrow General Hershey had you. If some reasonable definition of essentiality is not arrived at, and this definition is not made to stick even under rather extreme conditions, a lot of the men who were too valuable to be reserve officers are going to be toting a rifle or swabbing a deck. This might please Selective Service, but it would not be any benefit to the country, which needs all of the professional skills it can get.

This proposition should have a lot of serious study. It is no help to avoid one mudhole and straightway run into another and deeper one. If the much-talked-of and long-needed study of the needs for and utilization of scientific personnel could be carried through, it might answer many of the basic questions that are involved.

Built to sweeten a city's breath without souring its budget

You can collect garbage faster at lower cost when you have a specialized International Truck at work for you.

With this truck your men can make more pickups and cover longer routes. With this truck you can build up good will and at the same time cut down on hauling costs. Here's why:

Heavy-duty engineered to save you money

Stop-and-start operation doesn't get the best of an International Truck.

Every International Truck has extra strength heavy-duty engineered into every part. This is the same extra strength that has kept Internationals first in heavy-duty truck sales for 18 straight years.

What does this mean to you? It means lower operating and maintenance costs, fewer tie-ups of your garbage equipment, longer truck life.

Your men cover their routes faster

An International turns in the shortest practical circles. This speeds pickups in alleys and makes it easier for your men to get in and out of the dump area.

In addition, there's a new world of comfort in the Comfo-Vision Cab—"roomiest cab on the road." There's full front visibility through a one-piece, curved Sweepsight windshield. There's more positive steering control from a more comfortable driving position.

Dispose of your garbage disposal problems now

You can get all the facts from your nearest International Truck Dealer or Branch.

International Harvester Builds
McCormick Farm Equipment and Farmall Tractors
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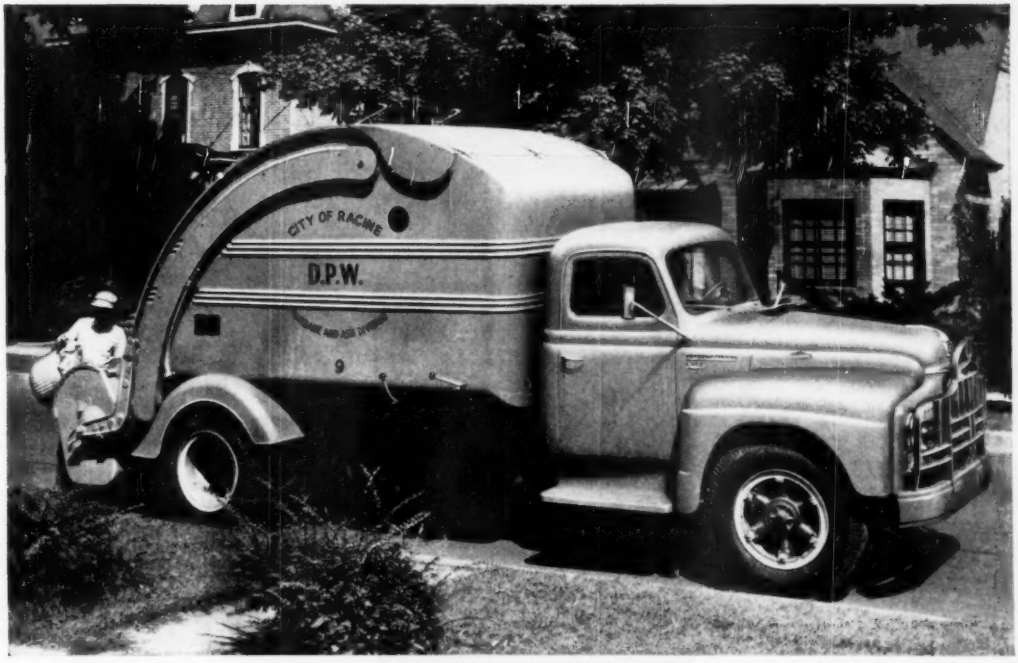
INTERNATIONAL TRUCKS

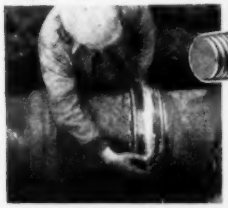
INTERNATIONAL HARVESTER COMPANY CHICAGO



When you need special information—consult READERS' SERVICE DEPT. on pages 93-97.

Clean pipe thoroughly — then center brass band over break, bending tab back to lock.

Thoroughly soap both sides of gasket and pipe with heavy soap water.



Center gasket and Monel Band over brass band.

Assemble halves of clamp over pipe and bolt together.

Insert pull bolts and tighten all around evenly.

SKINNER-SEAL SPLIT COUPLING CLAMP

When writing, we will appreciate your mentioning PUBLIC WORKS

tax savings for the future

Three billion, two hundred and fifty million dollars*—that's what it will take to foot the bill for new water system construction so urgently needed by the American people during the next ten years!

For the thousands of communities that must carry a share of this additional investment, the vital need for water system expansion is most unwelcome at this time in the face of constantly rising costs.

This means that, wherever possible, water works officials will be called upon to keep an exceptionally close watch on expenditures . . . to see that the money laid out for new systems brings the greatest possible return to the taxpayer.

Since a sizable part of the cost of any water system involves the supply and distribution lines, an important question to be answered by these officials will be: "Which pipe will give the greatest return from this portion of our investment?"

Thousands of communities have already found the answer to this question in Transite Pressure Pipe.

A threefold warranty of economy is built into every length of Transite Pressure Pipe . . . the modern pipe developed by Johns-Manville through research and engineering to carry water more efficiently:

1. ***Long service life*** . . . because Transite Pipe is made of three inherently corrosion-resistant materials—asbestos, cement and silica—and is steam cured under pressure by a special Johns-Manville process which assures *maintained strength in service*. Carefully kept records of performance in highly corrosive soils prove that conditions which seriously weaken other pipe materials have little effect on Transite.

2. ***Low operating costs*** . . . because Transite Pipe has a smooth interior surface which provides a high water-carrying capacity (C=140). Moreover, because Transite cannot tuberculate, this high carrying capacity *remains* high through the years. Pumping costs, as a result, stay low. Delivery of a full volume of water at lowest operating cost is assured.

3. ***Maximum water economies*** . . . because Transite Pipe has tight, yet flexible joints that *stay* tight in service. These joints absorb vibration and soil stresses, cut down on costly underground water leakage. This is especially important today when water supplies in many localities must be conserved to the limit to meet constantly increasing water consumption.

In addition to these assurances of tax savings for the future, Transite Pressure Pipe offers many *immediate* economies, such as important savings in time and money during installation . . . further sound reasons why it will pay you and your community to specify Transite for the greatest return from your pipe investment.

*From THE WALL STREET JOURNAL, May 26, 1950

For complete information write Johns-Manville, Box 290, New York 16, N. Y.

TRANSITE PRESSURE PIPE

Transite is a registered Johns-Manville trade mark

TODAY'S FILTER PLANTS

use vitrified clay filter bottom blocks

Vitrified clay filter bottom blocks like those used in this secondary Biofilter resist acids, won't clog, are easy to lay and have been proved by use in hundreds of modern filter plants.

THE PLANT:

Capacity, Av. Rate Flow 560,000 gpd

Peak Rate Flow 1,400,000 gpd

Recirculation ratio of 1.25 to 1

Floor of Vitrified Clay Filter Bottom Blocks

1 Final setting tank 45 ft. dia., 9.0' swd.

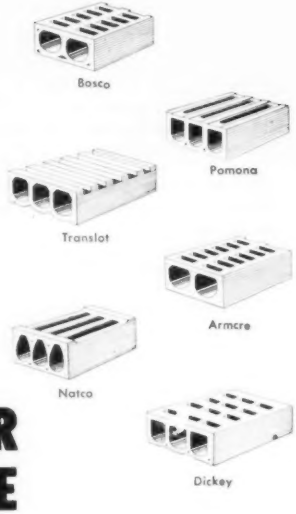
2 Float control recirculating pumps

PLACE: **MECHANICSBURG, PA.**

ENGINEERS: **Gannett, Fleming, Corddry and Carpenter, Inc.**

THE ENGINEERS: Gannett, Fleming Corddry & Carpenter, Inc., is 35 years old and has handled more than 2,000 assignments. These consisted mainly of the design and supervision of construction of such varied projects as sewage and water treatment plants, sewage collection systems, highways (including design of sections of the Pennsylvania and New Jersey Turnpikes), bridges, airports, military cantonments and munition plants, dams and boiler plants. In addition a valuation division is engaged in making appraisals and valuations of utilities for purchase, financing and rate making.

THE BLOCKS: Floors in modern filters like that pictured above are built with *Vitrified Clay Filter Bottom Blocks* made by members of the Trickling Filter Floor Institute. They are self-aligning. Large top openings give full drainage and ventilation at all times. Their walls are smooth so solids don't cling. They are especially designed to give best results in all types and shapes of filters. For life-time, trouble-free service, specify these one-piece *Vitrified Clay Filter Bottom Blocks* on your next filter.



TRICKLING FILTER FLOOR INSTITUTE

W. S. Dickey Clay Mfg. Co. Kansas City 6, Mo. | Ayer-McCarel-Reagan Clay Co. Brazil, Ind. | National Fireproofing Corp. Pittsburgh 22, Pa. | Bowerston Shale Co. Bowerston, Ohio | Pomona Terra-Cotta Co. Pomona, N. C. | Texas Vitrified Pipe Co. Mineral Wells, Tex.

Get full details of this month's new products . . . mail your Readers' Service card today.

Here is the New Yardstick for Crawler Tractor Performance

Allis-Chalmers HD-20 Hydraulic Torque Converter Tractor

● **BIG AND RUGGED** . . . 41,800 lb. of properly balanced weight . . . long, wide, sure-gripping tracks. Handles the toughest jobs in stride!

● **POWERFUL** . . . Newest, latest GM 2-Cycle Diesel Engine; Model 6-110. Plenty of POWER . . . for longer life, lower maintenance, increased production.

● **HYDRAULIC TORQUE CONVERTER DRIVE** that eliminates most gear shifting and keeps tractor working smoothly at higher average speeds.

● **SIMPLE UNIT ASSEMBLY** . . major assemblies removed and repaired or replaced without removing adjacent parts.

● **EXTENDED LUBRICATION PERIODS THROUGHOUT** . . . plus 1,000-hour periods on truck wheels, track idlers and support rollers with A-C's POSITIVE SEAL.

● **EVERY OPERATOR COMFORT** . . . seat, platform, controls, visibility . . . hydraulic finger-tip steering, self-energizing brakes, practically no gear shifting.

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World's Finest Tractor

For Greater Production
For Easier Operation
For Simplified Servicing

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Originator of the Torque Converter Tractor

LETTERS

TO THE Editor

SLIGHTLY WRONG

Being a little behind in my reading, I noted only recently that the chart accompanying the article on "Drop Dilution Method for High Chlorine Residuals (page 79 and 80, Sept. issue), appears to be in error. My calculations indicate that the ppm designations on your curves have been reversed. Anyway, this is a good trick and I'll have some use for it.

J. Wiley Finney, Jr.,
Tennessee Department of Health, Nashville, Tenn.

(Ed. Note: Mr. Finney is correct; the ppm designations on the curve were inserted in reverse order. Sorry.)

THANKS, CLYDE

Please allow me to express my belated thanks for the most excellent summary of our 1949 annual report which was carried in your September issue. I believe you did a better job in rewriting than we did in the original report.

Clyde R. Harvill,
Sanitary Engineer,
Water Division, Houston, Tex.

(The Editor says no amount of rewriting can make a poor report good. The original valuable material was there).

POSITION WANTED

At present I am working on reinforced concrete design but I would like to get into the sanitary or public health engineering field. I have a BS in CE; am married, with two children: had some experience with General Electric and with New York State Highway Dept., and during the war was an aerial navigator. I am 27 years old. At college, I finished in the upper third of my class.

For information about this young man, write the Editor of Public Works.

YOUNG MAN WANTED

We need a young man with technical training, water works experience and, if possible, some sales ex-

perience. When trained we would want this man to take over full responsibility for the sale of the materials we manufacture. The position would entail a combination of duties including office work, travel with our agents and attendance at water works meetings. We feel that the man should be, preferably, between 30 and 35 years old. We have not set the salary we intend to pay as it will depend on the quality and background of the man we finally select.

For information on this position, write to the Editor of Public Works.

BOOKS IN BRIEF

SEWAGE WORKS INDEX

This is an index of the articles appearing in Sewage Works Journal from 1928 through 1948. The index comprises three main sections, with listings by author, subject and geographical location. There are 9,000 entries. 144 pages. $4.50. Garrard Press, Champaign, Ill.

SNOW MELTING

This is a mighty fine book on the subject of snow melting systems for roads, driveways and sidewalks. It tells you just how to start and carry through your design. To speed up the work, there are 27 large size working charts covering the pipe size and spacing for various types of jobs. You will find what you want to know on anti-freeze solutions, air venting, pipe friction, pump selection, costs of installing and costs of operating. Also, you will find information on methods of design using buried electric cables. By T. Napier Adlam; 224 pp., 189 ills. The Industrial Press, N. Y. $4.50.

CLEAN WATER

This new booklet by the Public Health Service explains five necessary steps in a program of public action to develop comprehensive water pollution control programs. It is attractively illustrated. Single copies without charge from U. S. Public Health Service, Washington 25, D. C.

POLLUTION IN TENNESSEE

This is a report of the Stream Pollution Study Commission of the

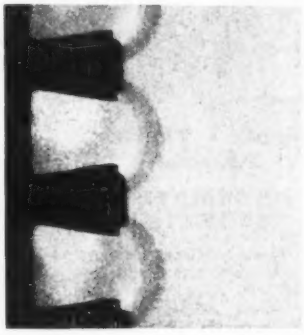
(*Please turn to page* 26)

EVERDUR
for well screens

Famous for exceptional resistance to corrosion, high strength, and adaptability to money-saving fabricating methods.

Cross sections, slightly enlarged. Everdur rod-and-wire welds made at 15 to 28 per second.

Well screen being fabricated by unique method of resistance welding.



Micrograph of lengthwise section showing excellent fusion of Everdur resistance welds.

Johnson Well Screen, 16" O.D. 35' long, being owered into well casing.

Extremely resistant to corrosion. Most water works engineers know that Everdur* is stubbornly resistant to corrosion. Everdur Well Screens have been a standard product of Edward E. Johnson, Inc., St. Paul, Minn., for more than 20 years. Their service records add further confirmation to many other reports proving the suitability of Everdur for water works and sewage treatment equipment.

High strength, too. It's pretty well known, too, that Everdur Alloys are strong and highly resistant to fatigue.

Exceptional weldability. But not everybody knows that Everdur has unusually good oxy-acetylene and electric welding qualities. That means economy in fabricating lightweight, low cost, wrought metal assemblies.

Everdur is available in practically all wrought forms including sheets, plates, rods and bars; and in structural shapes such as angles, channels, tee shapes and "I" beam sections; also in casting ingots. If you would like to know more, just write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

Where corrosion resistance counts —use Everdur

ANACONDA®

COPPER-SILICON ALLOYS

*Reg. U. S. Pat. Off.

When you need special information—consult READERS' SERVICE DEPT. on pages 93-97.

DEMPSTER-DUMPSTER RUBBISH COLLECTION

What It Is — How Cities Use It To Cut Costs, Increase Cleanliness

Cities like Baltimore, Richmond, Nashville, Boston, Cincinnati, Birmingham—to name a few—are spotting big Dempster--Dumpster Containers at Schools, Hospitals, and Hotels . . . Apartment, Housing, Business and Market Areas for more efficient and sanitary collection of bulk rubbish. These containers are eliminating unsanitary trash cans, crates, boxes, rats, scattered trash, open trucks and with it making almost unbelievable savings.

Here is a brief explanation of this revolutionary method of bulk rubbish collection:

Operated By One Man

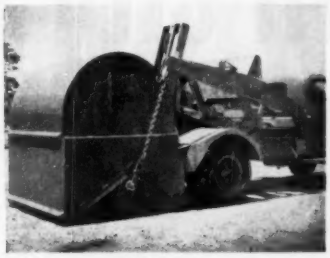
The Dempster-Dumpster System is, simply stated, one or more truck-mounted Dempster-Dumpsters, each with only one man, the driver, servicing any required number of detachable Dempster-Dumpster Containers, ranging in size up to 12 cu. yds. The Dempster-Dumpster makes scheduled calls at housing, market and business areas, hospitals, schools, etc. and picks up each pre-loaded container, hauls it to disposal area where contents are dumped automatically, then returns container to replace another pre-loaded container. This single truck-mounted Dempster-Dumpster services any number of containers, one after another.

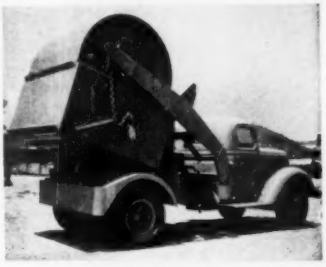
The cleanliness of the Dempster-Dumpster System is due to the completely closed steel containers. Trash and refuse cannot be scattered over streets and alleys by winds or scavengers. Dempster-Dumpster Containers are fire-proof and rat-proof.

System Grows as Needed

The City of Birmingham started out with one Dempster-Dumpster and 10 containers in 1938. Now Birmingham has 12 Dempster-Dumpsters servicing 204 containers. Richmond, Va. started out with two Dempster-Dumpsters and 13 containers in 1946. Today Richmond has six Dempster-Dumpsters servicing 196 containers. And so on down the line in city after city where the Dempster-Dumpster System is saving sanitation departments thousands of dollars annually. For example, when Richmond replaced the conventional open truck method of bulk rubbish collection in the business area with the Dempster-Dumpster System, it cut collection costs from $1.03 to .43 per cubic yard.

The pay-load capacity of the larger Dempster-Dumpster Containers is equal to or greater than conventional truck bodies. It is important to remember that containers are available in many different designs of every desired size. For instance, where moist or wet rubbish is a problem, a Dempster-Dumpster container is built to take care of it. And, bear in mind, regardless of the different designs or sizes of the containers you use at various points, one truck-mounted Dempster-Dumpster can service them all.

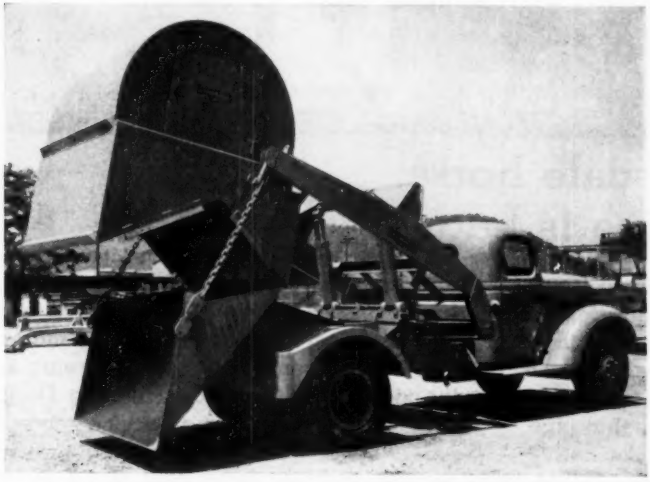




PICK UP AND HAULING OPERATIONS are shown in the two photos above. Driver backs Dempster-Dumpster up to Dempster-Dumpster Container, which has been pre-loaded by user, slips lifting chains onto lugs at each end of container, then, by hydraulic controls in the cab, lifts container into carrying position and drives to disposal area.

The Dempster-Dumpster System triples man-hour efficiency . . . reduces truck investment, gas, oil, maintenance costs . . . improves "housekeeping" methods . . . reduces fire hazards . . . provides an easier, quicker, safer and more effective manner of handling bulk trash and refuse.

Upon request Dempster Brothers engineers will be glad to prepare, at no cost to your city, a complete report for your particular municipal bulk rubbish collection requirements to determine the extent to which the Dempster-Dumpster System would justify its purchase and just what equipment would be required for efficient bulk rubbish disposal.



DUMPING POSITION of this 10 cu. yd. Apartment Type Dempster-Dumpster Container is shown above. Its payload capacity is greater than the average conventional truck body. Container is placed in dumping position hydraulically and drop bottom section of container is lowered for dumping . . . all under complete control of driver in the cab.

DEMPSTER DUMPSTER
TRADE MARK REG.

DEMPSTER BROTHERS
911 Dempster Bldg.
Knoxville 17, Tenn.

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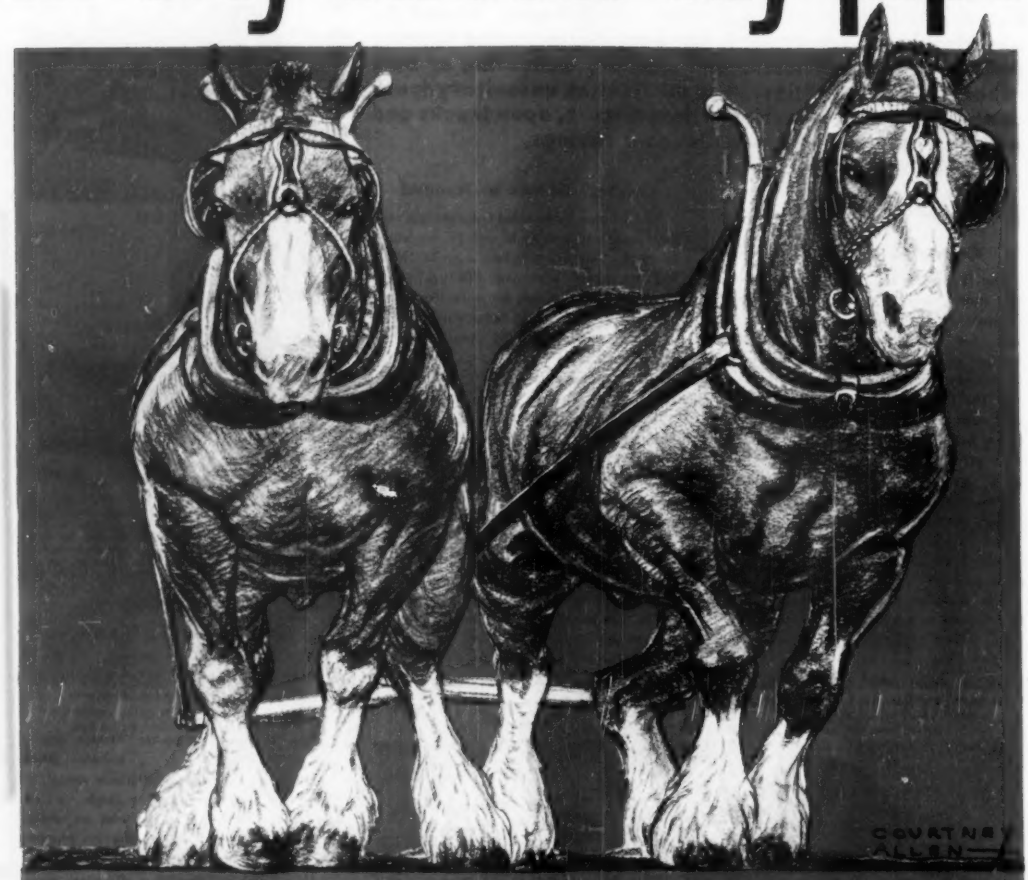
in city streets lay pipe



Like a Clydesdale horse cast iron pipe is known for strength

Known strength factors! Proved resistance to corrosion! These are your only safe and sure guides to long life and low maintenance expense of water, gas and sewer mains laid under costly modern pavements. The four strength factors that pipe must have to survive traffic shocks, heavy external loads, beam stresses and severe working pressures are listed on the page opposite. *No pipe that is deficient in any of these strength factors should ever be laid in paved streets of cities, towns and villages.* Cast iron water and gas mains, laid over a century ago, are serving in the streets of 30 or more cities in North America. These attested service records prove that cast iron pipe not only assures you of effective resistance to corrosion but all the strength factors of long life and economy, as well.

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known for STRENGTH

No pipe that is deficient in any of the following strength factors should ever be laid under paved streets.

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

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The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

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In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

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THE OLIVER CORPORATION

Industrial Division: 19300 Euclid Avenue, Cleveland 17, Ohio

A complete line of Industrial Wheel and Crawler Tractors

BOOKS IN BRIEF

(*Continued from page* 19)

State of Tennessee, and we think it might well serve as a guide and perhaps a model for other reports. It covers needs, cooperation with other states, policy steps in abatement of pollution, methods of financing and recommended legislation. Its 76 pages contain a great deal of data that should be of value to other states and other communities. We believe copies can be obtained from Charles Crangel, Acting Director of State Planning, 417 Seventh Ave., N., Nashville 3, Tenn.

LEADERS IN PUBLIC WORKS

Ralph E. Fuhrman, shown on this month's front cover, is the new president of the Federation of Sewage and Industrial Wastes Associations and one of the outstanding younger men in the field. He is Superintendent of the Sewage Treatment Plant, Government of the District of Columbia, and for the period 1937 to 1942 was assistant superintendent. Just now, he is also directing an Upper Potomac River Industrial Wastes Investigation for the Potomac River Commission, under a Johns Hopkins fellowship.

A graduate of the University of Kansas with the degree of BS in CE in 1930, he also has a master's degree in sanitary engineering from Harvard, earned in 1937. From 1941 to 1950 he was instructor, on a part-time basis, in sanitary engineering courses at the George Washington University. He says "I enjoyed this work very much, but had to give it up to accept the Hopkins fellowship." He holds membership in FSWA, ASCE, AWWA, APHA and Delta Omega.

Many at the Washington convention met the charming Mrs. Fuhrman. The Fuhrmans have two children, a boy 10 and a girl 6. As to Ralph's hobbies, he says they are photography, philately and chess—a high-brow group, indeed, and hobbies that require concentration and knowledge.

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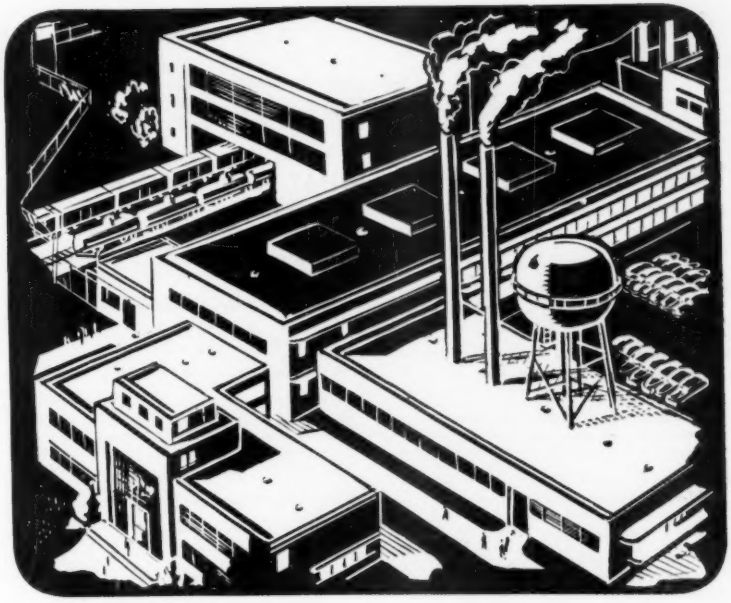
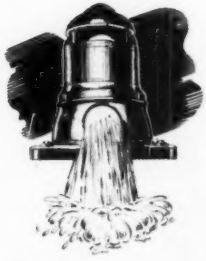


An overwhelming percentage of the Nation's largest Industrial plants obtain their water supply from Layne-built wells and pumps.

It is true that LAYNE LIKES COMPETITION!



Competition has been responsible for making Layne the world's best known builder of Well Water Systems and high efficiency Vertical Turbine Pumps. It was the low production and short life of competitive wells that caused Layne to originate the famous underreamed gravel wall well;—the invention and building of horizontal louver sand screen and the innovation of scientific well drilling under full and accurate control at all times. Competition also caused Layne to design and build the finest Vertical Turbine Pumps ever offered to cities, factories and irrigation farmers.

Competition has been a delightful companion to Layne for years and years, and best of all it has been a wonderful guide in showing hundreds of things NOT TO DO in building dependable well water systems.

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VERTICAL *Turbine* PUMPS

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WHAT DIAMETER?

Copper Water Tube—
Type K—nominal diameters, ⅜" thru 4"
Type L—nominal diameters, ¼" thru 4"
Type M—nominal diameters ⅜" to 4"

Copper Refrigeration Tube—dehydrated—Seamless—ends sealed—individually cartoned from ⅛" thru ¾" O.D.

Copper Oil Burner Tube—
Coils cartoned individually—¼" thru ⅞" O.D.

AGA Copper and Aluminum Tube—
Semi-rigid—for connecting gas appliances to house piping—¼" thru 1⅛" O.D.

S.P.S. Pipe—
Red brass (regular and extra heavy)
Copper (regular and extra heavy)
Nominal diameters from ⅛" thru 3"

Capilator*—the capillary tube used for restriction purposes—seamless copper—drawn to close tolerance I.D. (± .001")—machine burred—ends paper-wrapped—washed inside—tested for pressure drop—from .026" I.D. thru .064" I.D.

WHAT TEMPER?

Water Tube—Type K—Hard and soft in straight lengths ⅜" thru 4" nominal. Soft in coils

Water Tube—Type L—Hard and soft in straight lengths ¼" thru 4" nominal. Soft in coils

Water Tube—Type M—Hard in straight lengths, 1¼" thru 4" nominal

Copper Refrigeration Tube—Dead soft

Copper Oil Burner Tube—Soft

AGA Copper Tube—Soft

S.P.S. Pipe—
Red brass—regular hard. Extra heavy soft
Copper—regular hard. Extra heavy soft

WHAT WALL THICKNESS?

Copper Water Tube—Type K—.049" thru .134"

Copper Water Tube—Type L—.030" thru .110"

Copper Water Tube—Type M—.025" thru .095"

Copper Oil Burner Tube—.049"

AGA Copper Tube—.049" thru .065"

S.P.S. Pipe—
Red brass, regular .062" thru .219"
Red brass, extra heavy .100" thru .304"
Copper, regular .062" thru .219"
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Copper Refrigeration Tube—.030" thru .035"

Capilator*—.023" thru .0305"

WHAT LENGTH?

Water Tube—Type K in 20 ft. straight lengths and in 60' coils, individually cartoned

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Water Tube—Type M in 20 ft. straight lengths only

Refrigerator Tube—50 foot coils—individually cartoned

Capilator*—cut to straight lengths up to 20 ft. maximum

WHAT BRAND?

Specify WOLVERINE . . . to be sure

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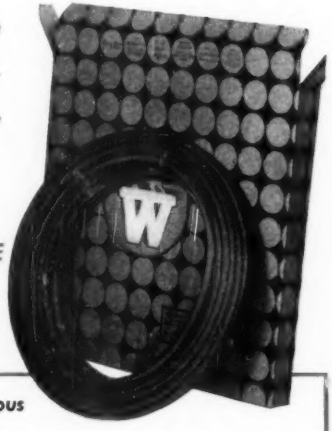

Wolverine tube . . . the quality-controlled seamless, non-ferrous tubing of long and dependable performance.

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MANUFACTURERS OF SEAMLESS, NON-FERROUS TUBING
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means continent-wide service for you

From Alaska south to Mexico, from Nova Scotia south to Texas . . . sales and service on Atlas and Superior Engines will be available on a broader, more complete scale than ever.

By the consolidation of Atlas sales and service with Superior's field facilities, you can now get engineering advice, replacement parts, and service promptly, wherever you and your engine are . . . whether it's a Superior or an Atlas.

Replacement parts for both lines of engines are now being produced at The National Supply Company's Engine Works in Springfield, Ohio . . . where both Superior and Atlas engines are also being produced.

Now, more than ever before, it will pay you to select the engine best suited to your needs from the complete line of Superior and Atlas engines. For the name of your nearest National Supply Company engine branch, write to

THE NATIONAL SUPPLY COMPANY
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DIESEL ENGINES . . . NATURAL GAS ENGINES . . . DUAL FUEL ENGINES

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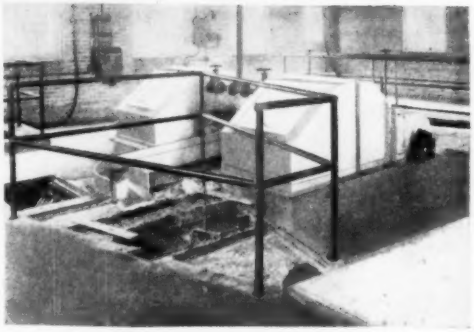
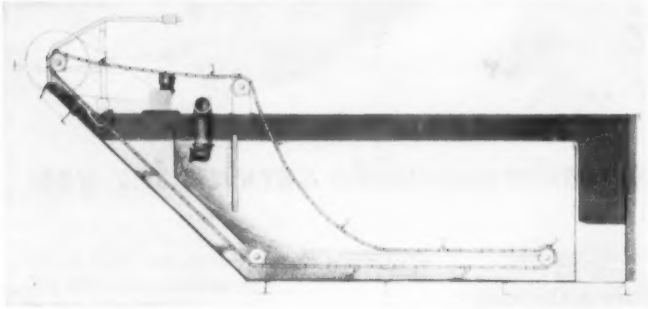
Let Link-Belt Help You Dispose of *Industrial Wastes*

Safeguard public health or salvage valuable by-products from waste water, or perhaps do both, by means of Link-Belt equipment for water, sewage and industrial waste treatment. Note the four typical applications here shown.

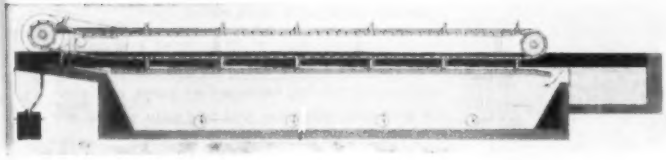
Link-Belt engineers, with a broad line of equipment and extensive experience, can aid you in planning and installing the right type of plant to solve your specific waste problems.



Above: Waste recovery system at large glue factory, consisting of enclosed revolving screens with settling pit and dewatering screw conveyor for the screenings.



Left: Coolant clarifying system utilizing Link-Belt dewatering conveyor. After clarification, coolant may be filtered or returned direct to grinding machines.



Left: Paper stock is recovered in the Link-Belt Save-All by a mechanical skimmer which collects the floating stock with a minimum of water.

Left: Heavy grit and detritus is removed from flume water at sugar beet factories, by settling in a tank equipped with a Link-Belt grit collector.

The Link-Belt line includes screens, sludge collectors, grit collectors, grit washers, chemical mixers, sludge dryers, power transmitting, elevating and conveying machinery.

LINK-BELT COMPANY

Philadelphia 40, Chicago 9, Indianapolis 6, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities. 11,813

LINK-BELT

Sanitary Engineering Equipment

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PUBLIC WORKS MAGAZINE

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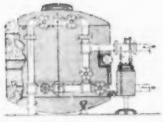
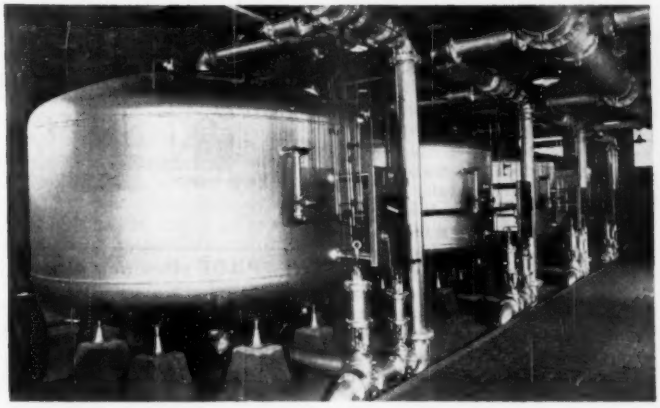




DESIGN FOR ECONOMIC AND EFFICIENT PRESSURE FILTRATION

This article was contributed by Reid Hobson and Peter Ley, both Professional Engineers. The former is Chief Engineer and the latter Plant Manager of the Jamaica Water Supply Co.

THE Jamaica Water Supply Company is a private utility operating in the Borough of Queens, New York City, and the adjacent western portion of Nassau County. The area supplied is approximately forty square miles but the water shed area from which the supply is obtained is greater due to the land surface contour. The entire supply is secured from 48 wells with an available yield of 60 mgd. With the addition of 4 wells presently under construction, the yield will be 67 mgd by the end of this year.

All of the wells are installed within the franchise area of the company and are strategically located to prevent interference with each other. With the storage facilities installed in the system, all distribution requirements are met without the need for large diameter transmission mains. The population supplied is approximately 475,000 and the average daily pumpage in 1949 was 40.5 mgd.

The distribution system to deliver the supply consists of 730 miles of main with an average diameter of 8 inches. With the exception of chlorination of a part of the supply for the control of iron bacteria, the only major application of treatment consists of the removal of iron and manganese. Equipment for this had been installed at two plant locations prior to the installation presently discussed. One of the plants (Station No. 6) is a gravity unit with a capacity of 5 mgd and consists of atmospheric aeration, chlorination, settling, filtration through a 27-inch sand bed, clear well storage, and then pumping to the distribution system. The other plant (Station No. 18), of 2 mgd capacity, consists of pressure units with a 48-inch depth sand and calcite filtering medium.

Need for Treatment

The iron and manganese content of 4 wells (8, 8A, 17 and 17A) located on two small plots of land about 0.4 mile apart in the Richmond Hill section of Queens County had been a source of complaint for a number of years. The water was treated with chlorine and sodium hexametaphosphate during the latter part of the period, construction of treatment facilities being deferred because of the heavy investment required in other plant facilities.

Test wells were drilled in a wide area adjacent to the four supply wells to determine if water of low iron and manganese content could be obtained, thereby permitting the retirement of the existing wells. The drilling operations disclosed that the iron and manganese content of the water from the test wells was equal to or greater than that of existing wells, and it was therefore decided to proceed with the construction of a treatment plant.

The area of the land at the well sites was not sufficient for the treatment facilities; and since the company owned another parcel nearby, it was determined to build one plant to treat the combined output of the four wells. Another factor influencing this decision was that one of the test wells, drilled at the site of the proposed plant, produced water of similar quality and of sufficient quantity to justify development at a later date.

Preliminary Investigations and Tests

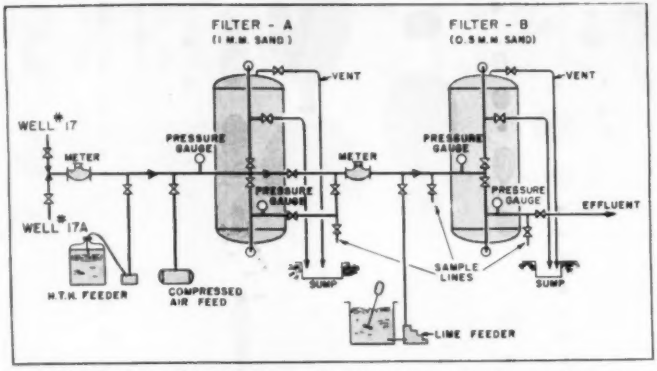
Four different processes were investigated as follows: (1) a gravity filter plant requiring double pumping; (2) a potassium permanganate pressure plant; (3) a lava and sand calcite pressure filter similar to the existing plant at Station No. 18; and (4) a fine sand pressure filter plant with shallow sand bed and low filter rates and pressure losses.

The first three processes listed were designed on the basis of laboratory tests of the water but the last process was the result of a pilot plant operation which should be of interest to all water work engineers and operators for its value in developing data to determine the most efficient and economical process.

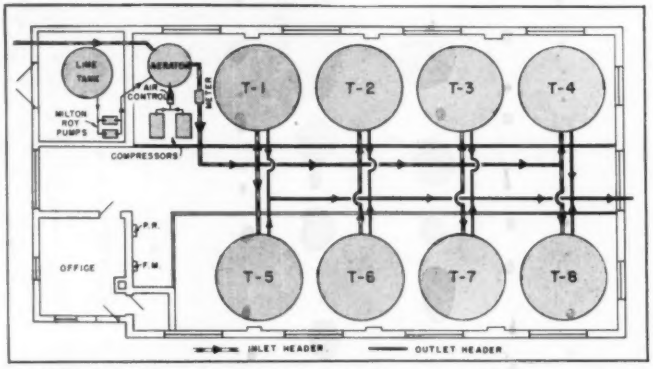
The equipment for the pilot plant was supplied by the Liquid Conditioning Corporation, subsidiary of Cochrane Corp., Jamaica Water Supply Company made the installation and the chemical analysis. The layout, shown herewith, consisted of the following items: (1) two 12-inch diameter by 5-ft. vertical height sand and gravel pressure filters; (2) one air compressor with storage tank; (3) one lime slurry feeder including a 30-gallon tank and Milton Roy pump and agitator; (4) one Wallace & Tiernan water operated hypochlorinator, and (5) valves, meters, gauges and necessary piping.

Filter A with coarse 1.0 mm sand and Filter B with fine 0.5 mm sand were operated in series with air, chlorine, and lime at rates of eight gallons per square foot per minute for Filter A, and four gallons per square foot per minute for Filter B.

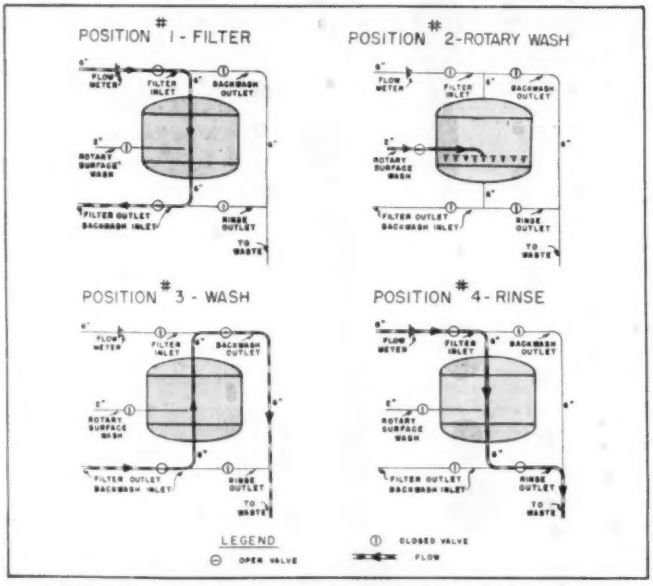
The results of this series of roughing filter operation showed a reduction of the combined iron and manganese content from 0.83 ppm in the influent to 0.04 ppm in the effluent. Other runs were made on the two filters separately to determine the most effective sand size. This was the 0.5mm sand in Filter B, use of which resulted in 0.1 ppm total iron and manganese in the effluent. The test runs revealed that the roughing filter A was not needed, and that a large plant with a 15" bed of fine sand would more than meet the desired standards. This decision was justified when the acceptance test of the completed plant showed only a trace of iron and manganese, with a pressure loss lower than the ten pounds allowable in the contract specifications. After a further analysis of capital and operating costs, this procedure was



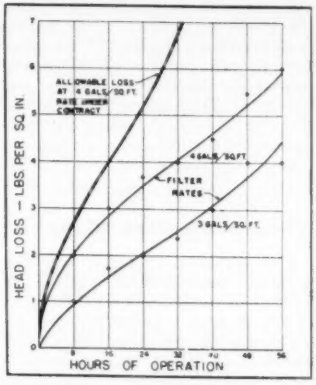
● ***PILOT plant flow diagram, showing filters, feeders and controls.***



● ***NORMAL flow through plant. FM, flow meter; PR, 3-pen recorder.***



● ***OPERATING cycle of wash, rinse and filter are shown here.***



● ***HEAD loss and filter rates.***

adopted and the contract awarded to The Cochrane Co.

The plant as constructed by Christie & Leiser, Inc., of New York, in 1949-1950, consists of a pressure tion other than the site of the wells has previously been given. Transite pipe was selected by reason of a high flow coefficient permitting the use of a smaller size pipe.

Plant Layout and Construction

Two main diagrams, shown herewith, illustrate the principles of operation of the plant: First; the flow diagram of the plant, and second, the operating cycle of wash, rinse and filter.

The head loss through the entire piping and filtering system between the influent and effluent header is shown in the figure herewith for rates of 3 gallons and 4 gallons per square foot for a filter run of 56 hours in comparison with the guaranteed maximum loss when operating at a 4-gal. per square foot rate. The loss of head curves indicates that operation at a 5-gal. rate would fall within the allowable limits.

To determine the effect of various types of treatment and the plant effluent resulting therefrom, test runs were made using chlorine; air; chlorine, lime and air; and chlorine and lime. The laboratory results of analysis obtained during these trial runs are shown in the table herewith.

Capital and Operating Costs

The total cost of the 5-mg plant exclusive of the transmission line to the site of the iron removal plant was $170,689.06 or $34,138 per mg. The capital cost breakdown is as follows:

Structure, Electrical, Plumbing & Heating	$56,565.29
Filter Equipment Controls, Tank Foundations, Compressors, Lime Tank & Pumps	111,948.55
Piping connections to Distribution System & Elevated Tank on site	2,175.22
TOTAL	$170,689.06

(*Continued on page* 85)

	Combined Raw Water	Treated Water						
Treatment Applied	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Chlorine; ppm	—	0.8	—	0.8	0.8	0.8	0.8	0.8
Air; ppm	—	—	12.0	12.0	—	—	—	—
Lime; ppm	—	—	—	11.4	7.6	10.6	12.2	13.0
Resulting Characteristics								
Turbidity; ppm	0	0	0	0	0	0	0	0
Color; ppm	0	0	0	0	0	0	0	0
Odor	0	Cl_2	0	Cl_2	0	0	0	0
Taste	0	0	0	0	0	0	0	0
Hardness; ppm	118	118	118	133	128	132	134	135
pH	7.1	7.1	7.1	7.7	7.5	7.9	8.1	8.3
Total Alk.; ppm	82	82	82	96	92	96	98	99
Free CO_2; ppm	18	18	17	5.0	8.5	2.5	1.5	0.5
Chloride; ppm	11.8	12.7	11.8	12.7	12.7	12.7	12.7	12.7
Iron; ppm	0.64	0.03	0.00	0.03	0.05	0.04	0.03	0.05
Manganese; ppm	0.22	0.14	0.15	0.13	0.16	0.07	0.05	0.02
Cl_2 Demand; ppm	0.20	—	0.09	—	—	—	—	—
Residual Cl_2; ppm	—	0.16	—	0.16	0.09	0.09	0.09	0.09

Present operation is that indicated by column 6.

aerator, influent header, eight 12-ft. diameter, vertical pressure filters with hydraulic valves operating on Roto valve settings for each cycle of the process, and appropriate flow and pressure instruments. The plant has a designed capacity of 5 mgd at a 4-gal. per square foot rate.

The discharge from the four wells is pumped through a Transite pipe transmission line to the site of the treatment plant. The reason for the construction of the plant on a loca-

OPERATING COST PER MILLION GALLONS

Electrical Energy to Procure Water Treatment		**$21.05**
Filter Friction (Average 7' Head)	$ .53	
Electric Energy—Air Compressor	.16	
Wash Water Consumption (2.4%)	.50	
Lime Consumption (12 P.P.M.)	1.00	
	2.19	2.19
Cost to Pump and Treat		**23.24**
Cost for Operating Labor		**8.89**
Total Cost Per Million Gallon Delivered Into Distribution System at 70# Pressure		**$32.13**

PLANNING FOR INDUSTRIAL WASTE TREATMENT

A. D. POTTER,
Senior Chemist
Bureau of Laboratories,
Texas State Department of Health

This article is based on a paper at the Sewage and Industrial Waste Section of the annual Texas Water and Sewage Short School

WHEN the construction of a manufacturing or processing plant is being contemplated, it is well for the interested parties to contact the appropriate state agencies to determine in advance if the wastes from the proposed plant will be considered objectionable. If the waste is considered to be of a polluting nature, preliminary agreements and plans can be made for the partial or complete treatment of the waste and acceptable methods of disposal determined. A description of the facilities for pollution control and the requirements that must be met should be prepared so that the personnel later charged with the responsibility for operating the plant will understand all the factors involved.

Many plants have been constructed and placed in operation without due consideration of the waste that will be produced. Although there are state laws regarding the pollution of streams, and management is cognizant of this, the failure to provide adequately for proper waste treatment is often not entirely management's fault. Frequently, the enthusiasm of the local citizens for a nice new industry and the accompanying payroll, together with management's natural desire to get the plant out of the blue print stage and into production, combine to minimize the problems of waste disposal as one that can easily be taken care of when the time comes. Then, suddenly, the time has come when action must be taken.

Under these conditions, the plant is faced with the necessity of taking immediate corrective action. Such hasty action usually results in make-shift arrangements that frequently prove to be both expensive and inefficient. If maximum benefits are to be derived from a pollution abatement program, it must be carefully studied and planned so that it will fit into the general manufacturing process with a minimum of change in routine operation. This will require careful study of the individual process units and of the waste with a view of increasing the unit process efficiency where possible and the probable use of the waste from one process as the coolant or carrier for another operation.

Conducting the Study

Such a study should be conducted by a waste specialist who is either a sanitary or chemical engineer. He should be responsible directly to a member of the administrative staff and have complete liaison with the engineering, technical, and production divisions. He should have had sufficient supervising experience to insure that he understands how to deal with people. Previous experience in laboratory and research on waste disposal would be desirable.

His preliminary survey should be an over-all study of the entire plant with a view of possible segregation of portions of the waste. Complete analyses of all the wastes from individual unit processes will enable the waste specialist to evaluate the entire problem and furnish information for the segregation of certain wastes for individual studies and treatment. In addition, this information can be used in making a critical analysis of the individual process for over-all efficiency and possible recovery of valuable by-products.

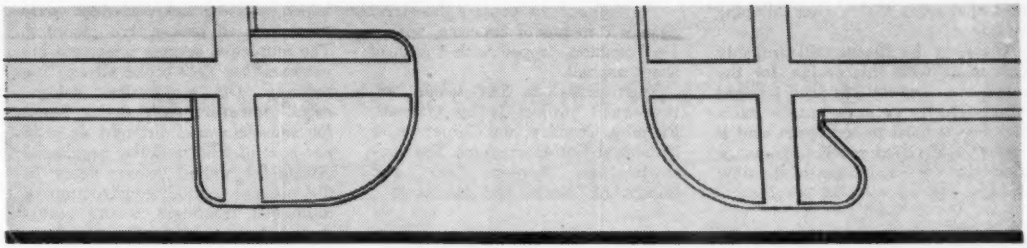
Examining The Waste

The character of the waste, the product manufactured, and the method of operation will determine to a large extent the analytical procedure that must be employed. For wastes of an organic nature, such as are produced by food product plants, the general sanitary criteria developed for the measurement and control of sewage can be used. But in chemical industries and metallurgical process plants, special chemical procedures must be used which are designed to fit the particular waste involved. For instance, if the waste contains sugar, starches and similar organic products that are readily attacked by bacterial organisms, the standard biochemical oxygen demand is an excellent gauge of the amount of polluting material that is present. But if saturated hydrocarbons or fatty acids are present, such materials are not readily oxidized by bacterial action and the standard BOD fails to indicate the amount of pollution present. In this instance, a chemical oxidizing method or oxygen demand would be a better criterion. And, again, certain organic and metallic compounds have a definite bactericidal action and tend to kill or inactivate the bacterial flora. In this case, neither the BOD nor the OD may give a correct estimate of the amount of pollutant present. Under these conditions, chemical procedures may have to be employed that involve special techniques. And, in some instances, entirely new procedures may have to be developed that are designed for the particular waste involved.

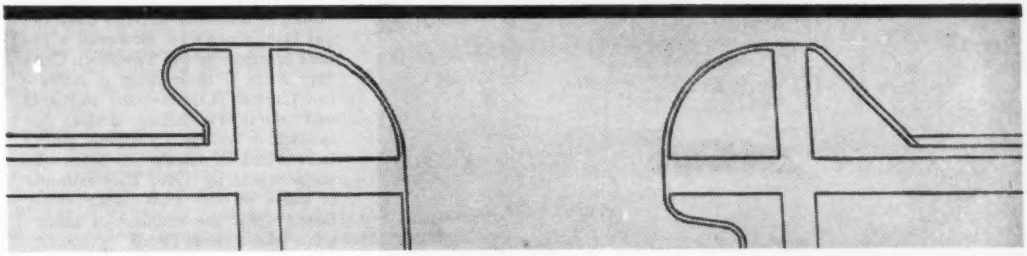
If the plant waste is to be discharged into a stream, the stream should be included in the study. Samples of the stream at various depths and at points both above and below the entrance of the plant outfall line should be examined to determine its chemical and aquatic condition. A limnologist should be utilized for this work.

In this instance, biological assays of the plant waste to determine the possible toxic effect of its constituents on the aquatic life of the re-

(*Please turn to page* 85)



CORNER "ISLANDS" ON DAYTONA STREETS



Guy Browning Arthur

THE $2,500,000 street improvement program in Daytona Beach includes the widening of Palmetto Avenue and three cross streets in the business district of the mainland side of the city. The mainland is separated from the coastal section, or the "peninsula," by the Halifax River. If this widening could have been straight-away work it would not have attracted attention, but an underground sewage pumping station at one corner made it impossible to widen this in the usual way. The distinctive design which resulted is a notable gain for larger cities.

Palmetto Avenue is the only north-and-south street between Beach Boulevard, which is the important shopping street bordering the Halifax River, and Ridge Avenue, which is US Highway #1, on the west. The distance between these two main streets is unusually long for a city, and the concentration of traffic in this area is high, in spite of inside parking areas provided for shoppers.

Palmetto Avenue was formerly only 18 feet wide, and was bordered by tall palm trees. William J. Lesman, Jr., City Engineer, says that parking was irregular and difficult to control. So the plans called for widening this avenue to 80 feet. Three cross streets, Magnolia, Bay and Volusia, running east to Beach Boulevard, were to be widened to 100 feet for increased capacity.

The sewage pumping station stood squarely in the way, under the southwest corner of Palmetto and Magnolia. It is a highly intricate installation, with a maze of piping and electrical arrangements. It is an "orphan," as such things usually are, and not wanted on any corner. It could not be moved out of the business district, and the cost of moving it to any other more suitable location might exceed $50,000. It was too near the surface to pave over it.

It was left as it was, and the design for widening sprang from this decision. All the sidewalk approaches to the intersections were made to conform to that imposed by the pumping station. The plan thus makes safety islands on the corners jutting out from the base width of the streets. Engineer Lesman agrees that the design is not good for fast traffic, but this is not a serious disadvantage in the leisurely living of a resort city like Daytona Beach.

For the pedestrian the design has remarkable advantages. The corner islands take up less street space than required for islands in the middle of a boulevard, and they give a greater sense of safety than middle islands can. The pedestrian feels that he is safely parked on the sidewalk, instead of dodging uncertainly between two streams of fast traffic, as on Beach Boulevard.

For the motorist it has equal advantages. Parked cars have an unusual measure of safety, both from cars turning in around corners, and from cars moving along the street. This is more noticeable on the wide streets than on Palmetto Avenue, which is only 80 feet wide. It is well known that every driver stays far away from possible side interference, and when he turns a corner from Palmetto Avenue he stays far out from the cars in the sheltered lane along the curb.

Other Advantages

It has still another effect at the intersections. Motorists swing safely away from the jutting corner islands, and away from people waiting to cross, keeping well out in the middle.

Ordinarily this design might cost more than straight-away designs, which turn the corners with sweeping curves. In Daytona Beach it cost less, because it saved the prohibitive

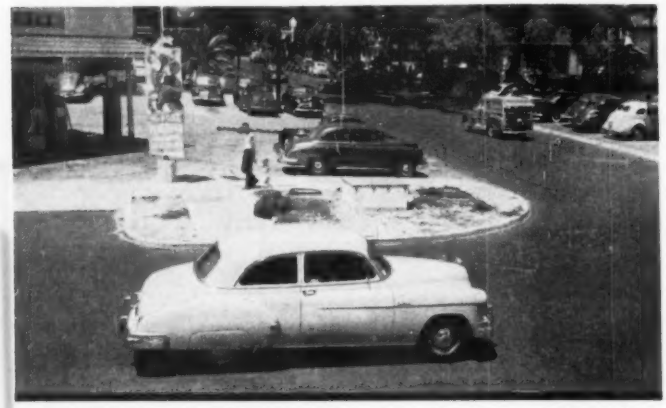
● ***HOW the sidewalk island juts out into the street.***

cost of moving the sewage pumping station.

Cleaning the streets will probably cost more with this design, for the machines cannot sweep straight through to the corners, but the extra expense is hard to segregate, and it cannot add up to much importance alongside the advantages of the new design.

Throughout the project the street base is 6 inches of concrete, with a 1½" cushion, topped with 1 inch of sheet asphalt.

Engineering on the whole improvement project is by Gannett, Fleming, Corddry, and Carpenter, of Pittsburgh and Harrisburg. The contractors are Brinson, Cone, and Manly, of Tampa and Leesburg.



● *CARS stay well out from the islands as they pass, giving pedestrians standing on the corners an added safety factor.*

NEEDS FOR SEWAGE AND INDUSTRIAL WASTE TREATMENT

These data are from a paper, presented at the Washington meeting of the Federation of Sewage and Industrial Wastes Associations, by Mark D. Hollis, Assistant Surgeon General, U. S. Public Health Service.

THERE are 20,000 significant sources of pollution in the United States, about equally divided between municipalities and industries. The pollution load discharged to watercourses by 6,000 municipalities amounts to a population equivalent of some 30,000,000. For the remaining 4,000 municipalities, which serve nearly 40,000,000 people, however, data on pollution load to watercourses are either incomplete or not available. We know that more than 5,000 of the 10,000 industries produce organic wastes. Two thousand of these produce wastes equivalent to a population of over 40,000,000. The other 3,000 plus industries produce organic wastes of which we have no measure.

In terms of overall national needs, nearly 6,000 new treatment plants, replacements of existing facilities, or enlargements or additions are required. Some 1,000 municipalities, however, have not yet had their needs determined. Nearly 3,000 industries need new plants, replacements, enlargements or additions, but the needs of over 5,000 industries have not yet been determined.

Before estimating national expenditures required to correct pollution, let us look at what has already been spent. From 1915 to date capital outlay for public sewage disposal construction has amounted to nearly nine billion dollars, indexed to 1949 dollar value.[1] During that period we spent, in addition, over one billion dollars for maintenance and repair. To this ten billion dollars we must add interest and operating charges to compute total expenditures. Comparable information on expenditures by industry on private treatment facilities is not currently available.

Municipal expenditures during 1949 totaling $227,000,000 is a gauge of the steadily increasing public support of water pollution control which can be acknowledged only by continued progressive planning. The municipal sewage treatment investment for 1949 broke all existing records.[2] On a physical volume basis, however, each dollar spent for sewage works brought only 85 per cent of what a dollar purchased during the highest prewar years. In the postwar period, construction of municipal treatment works accelerated at a rapid pace. Twenty-three plants were built in 1946, 93 in 1947, 167 in 1948, and 208 in 1949.[3] These 491 new plants are serving over 5 million people.

Regarding future need, cost data resulting from our surveys have not yet been completed. However, a recent estimate by the Twentieth Century Fund in their study of American Capital Requirements indicates that about 4¼ billion dollars for municipal sewage treatment works is required to satisfy our more obvious needs by 1960. This estimate is based on the 1950 dollar value. Based upon the number of industrial plants and needs previously noted, a conservative estimate of an equal value for industrial costs is made. Thus, a total expenditure of over eight billion dollars is indicated. A rate of expenditure nearly three times that of 1949, or about 800 million dollars annually will be required if we are to achieve our goal within the 10-year time period.

[1] Construction Statistics Summary, U. S. Dept. of Commerce, May, 1950.
[2] E.N.R. Vol. 144, No. 12, March 23, 1950.
[3] U. S. Public Health Service Water & Sewage Inventory.

TREATING RADIOACTIVE WASTES

Pure distilled water can be removed from dangerous radioactive wastes, according to a report by Dr. G. E. McCullough, a chemical engineer of the General Electric Co. The unit developed at the Knolls Atomic Power Laboratory, near Schenectady, N. Y., treats about 125,000 gals. per month at a cost of about 14 cents a gallon.

Wastes from all parts of the laboratory are collected in 10,000-gallon stainless steel tanks and fed into an evaporator. If necessary, the process of evaporation is repeated as required to obtain a satisfactorily low radioactivity. The remaining sludge is dried and discharged to a concrete shielded room. Further separation of this material is not deemed practicable and ultimate disposition of the dried material has not been determined.

BUILDING A FLOATING ROAD

TOURISTS who travel highway 63 between Ashland and Grandview, Wis., do so on a "floating highway." The recent relocation of this 11-mile stretch of road runs for about four miles through the Bibon Swamp, famous in American folklore as the home of Paul Bunyan. The road through this area is supported by the tremendous side and upward pressure of the Marshland muck many feet below the road surface. Thousands of tons of marsh material were excavated and earth fill was dumped into what seemed a bottomless pit. The pit continued to sink until the pressure was equalized and a reasonable stability obtained.

Last August, Bayfield County undertook the bituminous surfacing of the road as a Federal Aid construction job. Prior to this, almost two years were spent in sub-grading, marsh excavation, building bridges, and placing a 12-inch sand-gravel fill or ballast on the sub-grade; and covering with about 3 ins. of crushed gravel primed with SC-6 road oil. The road was opened for traffic one winter, then lifted with six inches of crushed gravel and then primed again with SC-7 oil. Upon this base was laid a three inch bituminous surface course using the blade-mix method. Considerable irregular subgrade settlement is still taking place in the excavated swamp areas.

Surfacing involved the use of 168,000 gallons of SC-7 asphalt on about 11 miles of bituminous (blade mix) surfacing. This job was accomplished in about 20 working days during August 1949. It was necessary to heat, unload, haul, apply, mix and finish approximately one 10,000-gallon railroad car of bituminous material per working day.

Equipment and Materials Used on Job

In completing this job the following equipment was used: one Bros tank car heater; one Bros booster; three 7000-gallon insulated supply tank trucks; one 1000-gallon insulated Rosco distributor with a 12-foot spray bar mounted on a GMC 6x6 chassis; 8 Caterpillar D12 diesel motor graders for mixing and placing; one Galion 10-12-ton tandem roller for finishing; and the usual amount of small tools.

About 1,200 cu. yds. per mile of dense graded crushed stone was windrowed on the primed base. This windrow was then spread gradually in about ¾-in. layers and each layer sprayed with SC-7 asphalt heated to 190°. Oil application was followed immediately by the motor graders mixing and again windrowing the material. This process continued until approximately 13 gallons of bitumin per cubic yard of crushed stone was incorporated in the mix. From 10 to 12 lateral movements across the roadway were required for proper mixing of the aggregate.

The moisture content of the gravel affected the mixing time considerably. If the moisture content was around 5% it was generally possible to process or mix about one mile per day with four motor graders, using two graders ahead preparing another mile for the next day's work and the other graders behind laying out or placing the mile previously mixed.

The quality of riding surface secured and the finished appearance of the bituminous surface depended greatly on the skill of the two grader operators doing the placing and to some extent the final operation of rolling.

The cost of the bitumen on this job was about 11 cents per gallon, f.o.b. Grandview. The cost of heating, hauling, and applying was about 3½ cents per gallon; and the expense of blade-mixing, placing, rolling and finishing came to about $900 per mile.

Bayfield County, the second largest county in area in the state of Wisconsin owns road equipment valued at a quarter of a million dollars. Besides a complete gravel screening and crushing plant, two complete oiling outfits and several dozen trucks of various sizes, the county owns nine Caterpillar D12 Diesel Motor Graders, four Caterpillar D8 track-type tractors, and two Caterpillar D7 tractors.

Courtesy Caterpillar

● ***DIESEL motor graders at work placing black-top surfacing on Highway 63.***

DOES SURFACE WASH EQUIPMENT

EDWARD S. HOPKINS
Principal Associate Engineer
Bureau of Water Supply,
Department of Public Works, Baltimore, Maryland

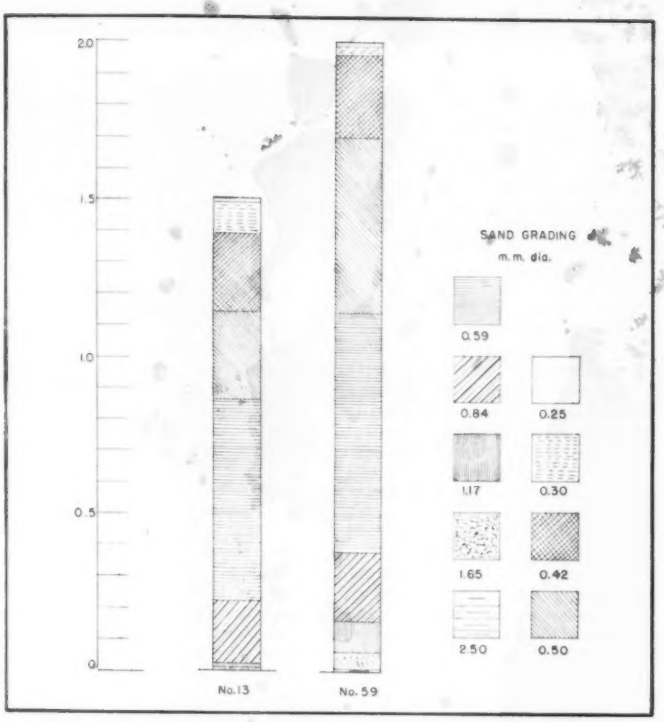
IN a filter, the period of service between washings is influenced by the rate of filtration, size of sand grains, depth of sand bed, concentration of floc in the applied water, air entrapment and viscosity of the water. It is recognized that when the top sand layers consist of fine grains, the floc is deposited on the surface of the bed or within the top 2 inches of depth.[1] Mud balls, when present, fall through the sand bed to the gravel layers when the bed is suspended during back washing. These deposits accumulate at the top of the gravel, building mounds and ridges which ultimately project through the sand layers, producing the irregular surface frequently observed. A typical example is shown herewith.

Surface washing equipment consisting of Palmer sweeps were installed in two of the Baltimore filters (Nos. 13 and 59) to determine their effectiveness and economic value. During the past 18 months, they have been utilized whenever the test filters were washed. Initially, about 25% of the surface area of the filters had become impervious due to the large mud deposits scattered through the beds. The surfase wash produced by the sweeps disintegrated these mud deposits. After 6 months of routine use, with washing in regular sequence, normal smooth sand surfaces were restored.

CHARACTERISTICS OF FILTERS

	No. 13	No. 59
Area, sq. ft.	1445	1380
Depth sand bed, ins.	18	24
Depth gravel bed, ins	15	20

The collection system in the No. 13 filter consists of bronze strainer plates with 1/16 inch diameter perforations spaced on 11/16 inch centers. In the No. 59 filter, the collection system consists of 1-inch planks resting on their side and spaced $\frac{5}{8}$ inch apart. Wash water is disbursed into the No. 13 filter through eight 14-inch lines spaced equi-distant. In the No. 59 filter, the 24-inch wash water line discharges into a sump located in one corner of the floor and the water is spread under the collection system by a series of vanes extending from the inlet.



● *FIG. 2. Sand sizes (see also Table I) in the two test filters after hydraulic grading, and as they exist when filter is in use.*

TABLE I.—SAND GRADING (PERCENT)

Mm. dia.	Filter No. 13	Filter No. 59
0.25	0.40	0.35
0.30	6.50	1.30
0.42	16.40	13.20
0.50	18.75	28.50
0.59	43.45	37.80
0.84	13.55	11.00
1.17	0.80	5.00
1.65	0.15	2.35
2.50	0.00	0.50

Sand sizes are shown in Table I and Figure 2. This diagrammatic system, developed by James W. Armstrong[2], presents a cross sectional picture of the sand layers after they have been hydraulically graded by the back washing and as they exist when the filters are in service.

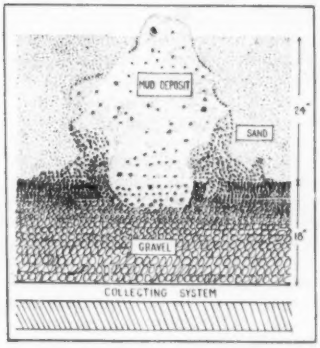
Initial filter operation was established at 2.7 gals. per sq. ft. per min. or 5.5 million gallons per day, and the units were normally kept in service until the rate decreased to 0.49 gals. per sq. ft. per min. or 1.0 million gallons per day. The normal penetration of floc approximated 2 inches for filter No. 13 and 4 inches for No. 59.

Back Washing

Back washing was accomplished as follows: Each filter was drained

FOR SAND FILTERS PAY ITS WAY?

to within 6 inches of the sand surface and the sweeps operated for 2 minutes, using water from the distribution system at 50 pounds per square inch pressure. The 24-inch wash water valve was then opened 6 inches, giving a velocity and flow that expanded the top portion of the sand bed and the filter washed for 3 minutes at this rate. At the end of this period, the sweeps were shut off and the wash water valve opened full. Back washing was continued for an additional 3 minutes with the valve opened wide (16 gals. per sq. ft. per min. rate) giving a final wash water turbidity of 75 ppm, which has been demonstrated as a satisfactory procedure to give maximum filter runs in *this* plant[3].

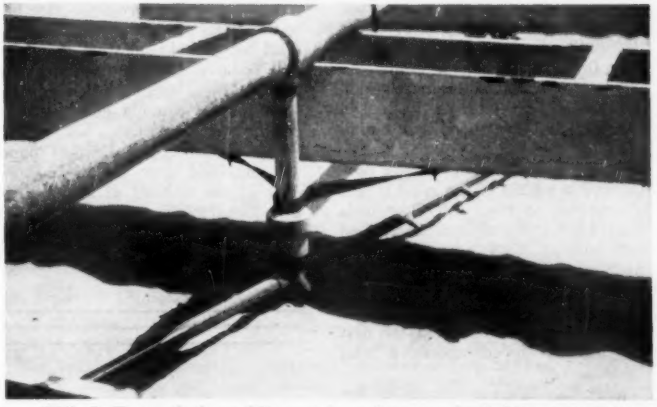


● ***FIG. 4. Effect of mud deposits.***

To determine the economic value of the sweeps, the volume of wash water consumed during an 8-month test period was compiled. An average of 139,913 gals. of water was required to back wash each filter not equipped with sweeps. The sweep equipped filters averaged 5,397 gallons from the distribution system and 134,100 gallons from the wash water system per filter. Wash water costs per filter were: for the conventional back wash, $6.00. With use of sweeps, the cost was: from the wash water system, $5.751, and from the distribution system, $0.279, a total of $6.03. This gives an increased cost of 3 cents per wash.

	Total hours in service	Units Washed	Av.
No. 13 filter	5,005	168	30.0
No. 1 Plant	151,540	4,526	33.5
No. 59 filter	4,075	75	54.3
No. 2 Plant	114,533	1,998	57.3

● ***FIG. 1. Surface of typical filter having serious mud deposits.***



● ***FIG. 2. Typical clean filter with surface wash. Baltimore installation was designed and constructed by Stuart Corporation.***

Filter Runs

As disclosed by Table 2, No. 13 filter averaged 30.0 hours between washings and the comparable units in the No. 1 Plant averaged 33.5 hours. No. 59 filter averaged 54.3

TABLE 2.—HOURS OF SERVICE BETWEEN WASHING DURING TEST PERIOD

Month	No. 13	No. 1 Plant	No. 59	No. 2 Plant
January	34.3	34.2	60.5	59.2
February	34.4	38.3	74.3	65.9
March	33.7	38.8	68.9	62.6
April	22.3	28.4	42.5	48.0
May	32.9	36.5	63.5	81.7
June	33.0	41.1	64.3	83.8
July	25.8	30.6	51.1	50.7
August	23.8	26.8	35.8	40.2

hours and the comparable units in the No. 2 Plant 57.3 hours.

It is believed that the longer filter runs shown by the other plant units are due to the presence in them of heavy mud deposits. It is conceivable, from the study of Figure 4, that water passes along the sides of these deposits and then laterally penetrates the sand bed, with resultant increase in total filter area. This condition would be particularly effective after the loss of head builds up. When it is recognized that a heavily impregnated filter has many mounds scattered through it, the increase in surface area, based upon this assumption, is of considerable magnitude.. Removal of these deposits by the sweeps reduces the filtering area to the top surface only and a decrease in the amount of water passing through the filter in a given time occurs.

Filtration Record

The volume of water passed through the sweep-washed filters averaged 181,145 gallons per hour for the No. 13 filter and 146,226 gallons per hour for the No. 59 filter. Filtration in the No. 1 Plant averaged 187,460 gallons per hour and in the No. 2 Plant 147,408 gallons per hour during the same period. Other filter units passed 2.3% more water than the sweep washed units. As previously stated, this increase in volume can be related to the lateral filtration effect produced by the mud deposits.

Yearly manual removal and mechanical washing of the sand layers is required to keep the filter beds in good condition when not equipped with sweeps. This is time consuming, requiring approximately 4 months to complete. The filters are overhauled in sequence and by the time the last one is cleaned, the first one has developed excessive mud deposits.

Economics of Sweeps

Based upon the present wage schedule, manual cleaning of a sand bed averages $186.56 per filter. Since the sweeps will eliminate this expense, it may be utilized to offset their cost. To equip a filter having approximately 1,440 sq. ft. requires 8 sweeps, which cost, installed $328.02 per sweep unit.

Purchase price of 8 sweeps	$1,473.68
Pipe and fittings	447.84
Labor installation	702.64
Total	$2,624.16

During the year the filters were washed 11,606 times, giving an annual increased wash water cost, with use of sweeps, of $5.80 per filter. These data may be recapitulated as follows: Cost yearly for manual cleaning, $186.56, from which should be deducted the cost of excess wash water, $5.80, leaving a net cost of $180.76. Deducting the yearly cost of sweep investment computed at 2%, which is $52.48, leaves a net annual saving of $128.28.

Thus, the investment in surface washing equipment will be equalized in 20.5 years. Since the sweeps will give service without major repairs for at least 20 years, their installation is economically justified.

Wholly apart from monetary considerations, the advantage of keeping the sand filter beds in good condition justifies the expense of sweep installation. There is always danger that, with penetration of floc into the deeper portion of the sand beds, by passage along the interior of a mud deposit, insufficient surface will be available to retain this floc and substandard water be delivered to the distribution system. This danger becomes more acute when the supply is taken from a "flashing" stream. Efficient filtration, as determined by production of a properly clarified water, rests upon a graded, uniform sand bed. The installation of sweeps will remove existing mud deposits, prevent their accumulation and assure the continuous delivery of a clarified water.

Information used in this paper was obtained from the official records of the Bureau of Water Supply, Department of Public Works, through the courtesy of Mr. Paul L. Holland, Director, and Mr. Leon Small, Water Engineer.

References

1. Armstrong, James W., Proc. Amer. Soc. Civil Eng., 62; 1543 (1936)
2. Armstrong, James W., J. Amer. Water Wks. Asso., 19; 402 (1928)
3. Hopkins, Edward S., "Water Purification Control", 3rd ed., p. 130, Williams and Wilkens Co., Baltimore, 1948.

STANDARDS

IN a trailer camp, an area of at least 700 square feet should be alloted to each car and trailer. Each unit should abut or face on a driveway or on a clear, unoccupied space not less than 20 ft. wide and should have unobstructed access to a public street or alley. There should be a space of at least 10 ft. between each trailer, or between a trailer, building or other structure. The site of the camp should have a good natural slope or satisfactory artificial drainage so that there will be no standing pools or puddles, and the drainage should be away from any water supply. If the soil is clay, access paths should be provided with gravel or concrete surfacing. Weeds should be controlled. There should be no rodent harborages, as piles of rubbish. If such stored materials as woodpiles are maintained, these should be placed on racks at least 12 ins. above ground.

Water Supply

An approved public water supply should always be used if available. If a private supply is used, this should be of a type approved by the State Department of Health. Periodic bacterial examinations must be made, and the water must be palatable and essentially meet the Public Health Service drinking water standards. Cross-connections must not be permitted.

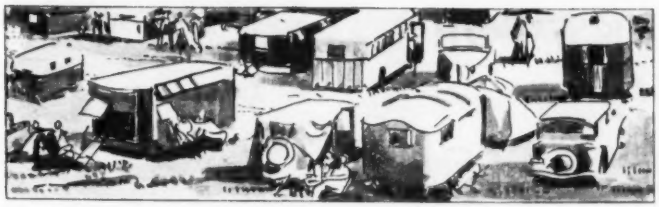
Whatever the type of water supply, it must be adequate and an outlet must be located within 100 ft. of each trailer or cabin. In trailer camps, it is required that the water be under pressure, with at least one outlet for every two house-trailer units. If an unsafe supply exists on the premises, all reasonable precautions must be taken to insure that it is not used for drinking or bathing.

In dispensing the water, common containers cannot be used. Drinking fountains and the methods of handling individual water containers must be in compliance with State Department of Health requirements. These may vary slightly from state to state.

Toilet Facilities

Separate toilet facilities must be provided for each sex, with at least one facility for each 15 persons or

FOR TRAILER AND TOURIST CAMPS



This article is based on the recommendations of the Division of Sanitation of the Kansas State Board of Health. It covers factors of value in both design and operation control. In addition to the items considered in this article, all local building, plumbing, electrical and similar codes should apply.

fraction thereof. This does not apply where each cabin has its own facilities, but does apply to all public installations. Water flush toilets must be used for all trailer camps and for all other camps where sewer connections are possible. Frost-proof toilets are not permitted. If privies are used, these must comply with State Department of Health standards. Toilet facilities should be easily accessible, and so located as to be within 200 ft. of all cabins and house trailers, but in no case should public facilities be closer than 25 ft. to a cabin or mess hall. Toilet rooms must be substantially constructed, screened, well lighted and ventilated. Floors must be of substantial construction, smooth and easily cleanable, preferably of concrete or other impervious material, sloped to adequate drains and with curbs extending 6 ins. above the floor. Lighting, whether natural or artificial, should provide five foot-candles.

If water is available under pressure, lavatories with running water must be provided, with at least one lavatory for each three toilets and/or urinals.

Sewage Disposal

A public sewer system should be used for disposal if available, and a sewer outlet should be provided for the combined waste outlet of each trailer. If a public sewer is not available, the treatment facilities to be provided will depend largely on the size of the camp and local conditions. A septic tank of adequate size to treat the wastes, followed by a tile disposal system or sand filter will usually be approved; however, where the camp is large or soil conditions unfavorable, a complete treatment plant may be required.

Septic tanks and disposal systems, if used, should be at least 75 ft. from the source of water supply or any part of a suction pipe of a ground water supply. Sewers, in which sewage may back up, must be of cast iron pipe if within 75 ft. of the water supply or a suction line. Privies must not be located within this same 75-ft. range.

Slop sinks, properly trapped and vented, must be provided in convenient locations and so that there is at least one within 200 ft. of each trailer. These must be provided with faucets which are protected against back-siphonage.

Buildings

In addition to being of substantial construction and in good repair, cabins and sleeping quarters should provide a minimum of 40 square feet of floor space per person; each cabin should have an area of at least 80 sq. ft.; in children's camps, there must be at least 3 ft. spacing between beds, and these should be arranged with alternating heads and feet. Electricity should be provided. Adequate ventilation is required; cabins should have at least two adjustable windows on separate walls with a combined area of not less than 10% of the floor area. All doors, windows and outer openings should be covered with 16-mesh screen. Screen doors should be self-closing. In rental buildings, the interior of each cabin must be cleaned thoroughly after each use. Heating appliances must be properly vented.

Bathing and Laundry

Public bathing facilities must be adequate, substantially constructed, conveniently located and used for no other purpose. When separate showers are provided, as is required for trailer camps, there must be separate facilities for each sex, and at least one shower for each 20 persons. Hot and cold water must be provided. Floors should be impervious, preferably of concrete or tile, and non-slip. Facilities must be available within 200 ft. of all house trailers or cabins. Bathing facilities must not be used for laundry or other purposes.

Laundry facilities, when provided, must be separate from the toilet and/or shower rooms; and the building must comply with the requirements for toilet facilities, as previously noted.

If swimming facilities are provided, these must comply with the State Department of Health regulations covering design, construction and operation of such facilities.

Garbage and Refuse

Containers must be non-absorbent, adequate in number to care for the waste produced, fly-proof and water-tight. At least one container must be provided for each two house-trailers or cabins, and at least one container must be available within 100 ft. of each. Garbage cans should be emptied at least once in two days; oftener if needed to prevent overflowing, and must be washed and cleaned after each emptying. If hauled away, the final disposal must be at least a half a mile away from any establishment frequented by the public. If disposed of on the premises, it must be ground and discharged into the sewer; buried with a well-compacted cover of at least one foot of earth; or completely burned in an incinerator.

WATERWORKS FOR TWO SMALL VILLAGES

● ***THE 50,000-gal. elevated water tank at Bigfork, Minn.***

AS the first step in the development of a water supply and distribution system for the Village of Bigfork, Minn., an 8-inch well was drilled, in 1947, to a depth of 173 ft. This drilling was done by the Keys Well Drilling Co. of St. Paul. Plans for a new water system were drawn by Hitchcock & Estabrook, Inc., of Minneapolis, consulting engineers, and in 1949 a contract was awarded to Casper-Lyons Co. of Grand Rapids, Minn., for installing a pump and constructing a pump house, the distribution system, and an elevated tank.

Under a subcontract, the turbine pump was furnished and installed by Fairbanks, Morse. This is designed to deliver 100 gpm against a head of 270 ft. Normal drive is by 10-hp electric motor, but a standby gasoline engine is installed against the possibility of power failure. The elevated steel tank and supporting tower work was subcontracted to the Chicago Bridge & Iron Co. The tank is of 50,000 gallons capacity with the bottom capacity level 100 ft. above the foundation capstones.

The Casper-Lyons Co. installed the distribution system, comprising about 12,000 ft. of 6-inch cast iron pipe. Hydrants were furnished by Waterous.

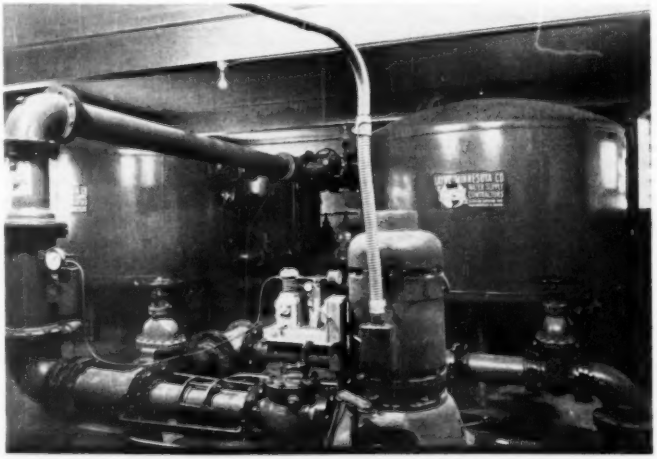
Bigfork is located in the northern Minnesota resort and timber area.

The Wadena Installation

It was necessary to augment an inadequate supply serving the Village of Wadena, Minn., population about 3,500. This supply consisted of several surface water wells, 35 to 40 ft. in diameter, plus a deep well. Test drilling adjacent to one of the existing shallow wells indicated an abundant supply of ground water was available at a depth of 52 to 72 ft. below ground surface. However, this water contained about 4½ ppm of iron. Equipment for iron removal was therefore provided in the installation, which was designed by Hitchcock & Estabrook.

A 12-inch gravel packed well was constructed by McCarthy Well Co. of St. Paul, Minn. Fairbanks, Morse furnished and installed a 400-gpm vertical deep well turbine pump designed to operate against a total head of 160 ft. Layne-Minnesota Co. of St. Paul furnished and installed a four-tank pressure filter type iron removal plant consisting of four vertical pressure filters each 108 inches in diameter and 5 ft. straight shell height; an air compressor; aerator equipment; and the necessary valves and piping. A building to house the installation was constructed by A. G. Peterson Construction Co. of Brainerd, Minn. A 6-inch propeller-type forward reverse twin dial meter to totalize both filtered water production and back-wash water consumption was furnished by Sparling.

Frank Wray acted as project engineer on the Bigfork job for Hitchcock & Estabrook, and Ray W. Lindsey was project engineer on the Wadena work.



● ***FOUR pressure filters, 9 ft. diameter by 5 ft. high, were installed at Wadena for iron removal purposes.***

MODERN LIGHTING SYSTEM FOR A MUNICIPAL AIRPORT

WM. P. HUGHES
City Engineer
Lewiston,
Idaho

THE planned airport program of the city of Lewiston, Idaho, continues to move ahead. The latest unit completed for this city of 15,000 (plus 10,000 in a 6-mile radius) is a modern runway lighting system costing $30,482.77, including $28,328.00 for construction and $2,154.77 for engineering. This brings a completed outlay to date of over one million dollars.

The Lewiston-Nez Perce County Airport, with a Class IV rating, was started in 1940 as a W.P.A. project. In 1942 when World War II got underway a C.A.A. project was approved and completed in 1944. This consisted of two 5,000-foot paved runways. Later two more C.A.A. projects were set up; one for an apron extension with entrance roads paved with a six-inch crushed rock base supporting a two-inch asphaltic concrete paving. This was followed by a sewerage system and the construction of a hangar and temporary Administration Building to house Empire Air Lines and the U. S. Weather Bureau. Empire Air Lines, one of the first feeder lines to be given a temporary certificate of necessity, has now been operating three years and gives every evidence in results of getting a permanent certificate next year from the C.A.B.

Supported by an air-minded city and county administration, and citizens at large, the lighting system was set up and approved, and was finished this last year. Four bids were submitted. The City Electric Company of Boise was awarded the contract May 4. The work began May 19 and was completed July 16. Total cost was $30,482.77; the Federal Government paid $17,161.80 of this, or 56.3 per cent of the project cost. The city and county each paid $6,660.49, or 21.85 per cent each.

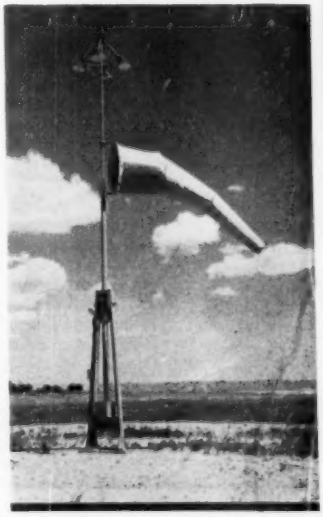
In addition to the lighting, runway markings were installed under the same contract. The markings consisted of numerals 60 feet in length painted white on the pavement at the ends of the runways. As a further aid to approaching aircraft, a lighted wind cone was installed at the center of a segmented circle which marks the location of the wind cone from the air. The circle was made of 20 concrete slabs, 12 feet by 4 feet, and laid on the ground in a circle 100 feet in diameter.

● ***HAPPY landings. This is a general view of the Lewiston-Nez Perce County Airport, looking west.***

Runway Lighting

The lighting system consists of 94 runway and 24 threshold lamp units together with more than five miles of interconnecting underground cable. The runway lamp units are clear and serve to outline the runways at night. They are placed at intervals of 200 feet and ten feet off the pavement. Six green threshold lamp units serve to mark the ends of the runways.

Each lamp unit is mounted in a weather-proof casing on a four-foot square concrete pad and is provided with a special mounting which if hit



● ***THIS lighted wind cone is marked with 100-ft. circle.***

accidentally by aircraft will break off at a fixed point. This practically eliminates the possibility of damage to aircraft and the lighting unit through contact. The entire lighting system is operated from a control panel located in the radio room of Empire Air Lines at the Main Administration Building.

The work was under the joint supervision of the C.A.A. District Airport Engineer Horace Glidden and C.A.A. Lighting Engineer Elmo Braden of Boise, Idaho, and Wm. P. Hughes, City Engineer, Lewiston, Idaho, with Norman S. Crossley, Assistant City Engineer in direct charge.

Breakdown of Costs

Description of Work	Quantity	Unit Price	Total Price
Elevated Marker Lights Clear	94	93.50	$ 8,789.00
Elevated Marker Lights Green	24	96.00	2,304.00
No. 8 1/c Underground Cable in Trench	20,500 lf	0.12	2,460.00
No. 8 2/c do	2,500 lf	0.27	675.00
No. 10 2/c "	2,600 lf	0.22	572.00
No. 8 1/c Underground Cable in Duct	2,200 lf	0.12	264.00
No. 8 2/c do	560 lf	0.27	151.20
No. 10 2/c "	560 lf	0.22	123.20
Trench for One Cable and Backfill	17,600 lf	0.30	5,280.00
Trench for Two Cables and Backfill	2,400 lf	0.35	840.00
Trench for Three Cables and Backfill	725 lf	0.40	290.00
3" Duct Encased in Concrete	256 lf	6.65	1,702.40
Wind Cone Externally Lighted, Complete	1 Ea.	805.00	805.00
Segmented Circle Marker	1 Ea.	1,050.00	1,050.00
Static Regulator Constant Current	1 Ea.	1,585.00	1,585.00
Runway Marking and Numbering	L.S.	1,125.00	1,125.00
Spare Parts Kit	L.S.	312.20	312.20
Total Price			$28,328.00

● *A CLOSE-up view of a typical runway lighting installation at the Lewiston-Nez Perce Co. airport.*

DESIGN

This is an abstract of Bulletin 13-R, issued by the Highway Research Board, Washington 25, D. C. Bulletin 13-R is available from the Board for 45 cents per copy.

AIR-ENTRAINED concrete is more plastic and workable than ordinary concrete; it can be handled and placed with less segregation; and the tendency to bleed or develop water gain after placing is reduced. Air-entrainment greatly increases the ability of the concrete to resist alternate freezing and thawing, and also scaling caused by the use of sodium or calcium salts for ice control. The sulfate resistance of the concrete is also improved.

The strength of the concrete is reduced by air-entrainment. It is generally agreed that a total air content of 4% to 5% by volume will give satisfactory improvement in durability without serious loss in strength. However, when using air-entraining materials, it is necessary to make sure not only that the mix contains the required amount of air but also that the air content is maintained within reasonable tolerances throughout the work. A good working range for control purposes is from 3% to 6% total air. These limits should apply to the concrete in place, in which the volume of mortar is 0.5 to 0.6 the volume of the concrete. Where the volume of mortar is appreciably more or less, the volume of air should be modified accordingly.

The modulus of elasticity of concrete mixes is reduced 2% to 3% for each percent of air entrained in the concrete. Volume changes due to moisture and temperature are not materially different. Bond with reinforcing bars is affected in about the same manner as compressive strength. Little data are available on absorption, permeability, elastic properties, plastic flow, shrinkage, fatigue and resistance to wear.

Materials

Air can be entrained in concrete either by use of a cement in which the entraining agent has been interground during manufacture, or by adding an air-entraining material during mixing, or by a combination of these methods. Portland cements containing a suitable air-entraining agent are made by most of the larger cement producers. Air-en-

and CONTROL of AIR-ENTRAINED CONCRETE MIXTURES

training admixtures, to be added to standard portland cement, and which are approved by the ASTM are: Vinsol Resin, Darex, N-Tair and Airalon. Air-entraining concrete also can be obtained by blending a natural cement with plain portland cement.

Normal well-graded aggregates of best quality should be used. A good rule is to use the aggregate specifications of your State Highway Department. The amount of air that will be entrained is affected by both the type and grading of the aggregates. Concrete made of crushed aggregates, as stone or slag, will contain about 1% more air than comparable concrete made with rounded gravel.

The variables that influence air content include the following: (a) Increasing the amount of sand in the mix will increase the amount of air; (b) rich mixes entrain less air than lean mixes; (c) wet mixes entrain more air than dry, stiff mixes; air content increases with slump to about 7 ins., but with further increase in slump, decreases rapidly; (d) machine mixing entrains more air than hand mixing; (e) entrained air increases with extended mixing time to about 15 mins., then decreases; (f) the amount of air entrained decreases as concrete temperature increases.

Since the amount of air entrained in the concrete cannot be left to chance, tests for air content both before and during construction are required regardless of the method used for entraining the air. An air content of less than 3% may not give the required resistance to weathering, and an air content in excess of 6% may reduce concrete strength without contributing any additional protection.

Designing the Mix

When air-entraining concrete is desired, specifications for proportioning standard mixes may be used as a basis. The procedure to be followed in redesigning such a mix for air-entrainment is best illustrated by an example. Assume that it has been decided to use air-entraining concrete in a pavement and that materials having the characteristics shown in Table 1 are available.

Courtesy Bureau of Public Roads

● ***RESEARCH** workers testing concrete for better structures.*

Table 2 gives the requirements for the mix. Assume a 7-sack mixer will be used and is available for a trial batch; and that suitable facilities are also available for determining the air content, consistency and yield of the trial batch.

Using these particular aggregates and a non-air-entraining cement, it will be assumed that concrete made in the proportions 94: 187 : 291 in pounds (aggregates saturated surface-dry basis) will meet all requirements except air content. The problem is to redesign the mix, using air-entraining cement or admixtures so that the concrete will comply with the requirements of Table 2.

TABLE 1—MATERIALS

	Specific Gravity	% Free Moisture
Cement	3.15	..
Sand	2.63	5.5
Stone	2.62	1.5

TABLE 2—CONCRETE MIX

Cement	6.5 sacks/cu. yd. ± 2%
Water	5.5 gals./sack, maximum
Slump	2 ins. to 3 ins.
Air content	3% to 6% by volume.

Experience indicates that increased yields resulting from air-entrainment will generally be compensated for by reducing the sand content of the batch by an amount equal to 3% of the combined weight of fine and coarse aggregate. This correction may be used in adjusting proportions for the first trial batch.

The total weight of aggregate in the reference given above is 478 pounds and 3% of this is 14 pounds. The mix for the first trial batch will then be 94: 173:291. A trial batch should be made up on this basis, using sufficient water to obtain the specified consistency. The weight per cubic foot of this trial batch is then determined by ASTM methods. Assume that the weight is 144 pounds per cubic foot and that this was obtained with 212 pounds of water. The batch weights for the adjusted 7-sack mix will then be as shown in Table 3 and the absolute volumes will be as shown in Table 4.

The theoretical weight, air-free, is found by dividing the total batch weight, 4,216 pounds, by the absolute volume. This gives 149.7 pounds per cu. ft. whereas the measured cubic foot weight of the trial batch was 144 pounds. The air content, from these two results is found to

TABLE 3—BATCH WEIGHTS

Cement (7 sacks)	658 lbs.
Sand (7 x 173)	1,211 "
Stone (7 x 291)	2,037 "
Free water in sand	67 "
Free water in stone	31 "
Added water	212 "
Total batch weight	4,216 lbs.

TABLE 4—ABSOLUTE VOLUMES

Cement (658÷3.15x62.4)	3.348 cu.ft.
Sand (1.211÷2.63x62.4)	7.379 " "
Stone (2,037÷2.62x62.4)	12.460 " "
Water (310÷62.4)	4.968 " "
Total	28.155 cu.ft.

be 3.8%, which is satisfactory. If this air content had not been within the required range, other adjustments would have been necessary. These might include a further slight adjustment of sand content; a slight change in the consistency; increasing the mixing time; or substituting another air-entraining cement for the one being used. If the air content is too high, plain portland cement may be blended in; and if too low, air-entraining admixtures may be added at the mixer.

In addition to checking the air content, the trial batch must be checked for compliance with other specifications. Thus: Volume of 7-sack batch is 4,216 pounds, divided by 144 (the measured weight) or 29.28 cu. ft.; the volume of a one-sack batch is 29.28 divided by 7, or 4.18 cu. ft.; and the cement content is 27 divided by 4.18 or 6.46 sacks per cu. yd. The water content is checked as follows: Free water in sand is 67 lbs.; free water in stone is 31 lbs.; water added is 212 pounds; total water is 310 pounds or 37.2 gals. The water-cement ratio is found by dividing 37.2 by 7, giving 5.3 gals. per sack.

Correction to compensate for water-cement ratios in excess of the maximum allowable, may be made by reducing the total aggregate weight, resulting in an increase in the cement content. In plain or reference mixes where the water and cement requirements are reasonably well balanced, it will seldom be necessary to make any adjustment. The introduction of entrained air will, as a rule, permit a reduction in water content of about 0.25 gal. per sack of cement.

In using air-entraining admixtures, the amount of admixture required is determined by trial, using three or four test batches. These are made up with the reduced sand content already described and with various percentages of the air-entraining agent. The air content of each batch is computed and the amount of admixture necessary to give 4% to 5% total air content in the concrete is determined. A final checking test is then made.

Construction Practices

In highway and airport pavement construction, some modifications in practice may be necessary. Primarily these have to do with finishing. Air-entrained concrete has greater plasticity and cohesiveness and is more sticky than plain concrete mixes. Consequently, some adjustment of finishing machine screed speeds or tilts may be required. However, placing and finishing air-entrained concrete requires no more attention than is required with normal portland cement mixtures.

When ready-mixed concretes are used, attention must be given to mixing and agitating time. Experience has indicated that the maximum amount of air is entrained in from 15 to 30 minutes in a truck mixer and that the air content is gradually reduced thereafter. However, the relationship is not so critical as to require undue controls, but consideration should be given to it when hauls or waiting times may be protracted.

OPERATION AND INSPECTION OF A SEWER SYSTEM

This is a portion of an instruction text issued by the Illinois State Department of Health, Springfield, Ill.

MOST important for satisfactory operation and maintenance of a sewer system is a master map of the system, together with larger scale sectional maps of portions of the system. These maps should show direction of flow, exact manhole locations, sewer sizes and slopes, house connections, location of other utility services with relation to the sewer, etc. Much time will be saved and damage to streets and private property will be minimized by having good maps and keeping them up-to-date. A permanent record of maintenance and inspection should also be kept. This should include dates of inspection, location of maintenance work, conditions found, equipment used, and costs.

Regular inspection of the entire system prevents trouble. Lack of personnel may make this difficult; however, an effort should be made to adjust your inspection program to this type of operation as closely as your local conditions will permit. Most general inspection practice recommends the following schedule: Sewers on flat grades or previously troubled by roots—every three months; sewers with which no difficulty has been experienced—once or twice yearly; main intercepting sewers—one to four times per month; inverted siphons—one to four times per month; storm water overflows—during and following heavy rains.

The following items should be considered in making an inspection:

1. Check manholes for odor of gasoline or presence of oil slick on sewage surface. If signs of gasoline or oil are found, work upstream on sewer, inspecting each manhole until the source of the oil or gasoline is found.

2. Check for unusual odors such as illuminating gas. It may be necessary to use an explosimeter in some cases.

3. Check manholes for sand, mud, or grit. Presence of an unusual amount of these materials may indicate broken or loose sewer joints or sewer pipe.

4. Check manholes for indications of sluggish flow, septic sewage, or accumulations of sewage solids. These may indicate obstructions in the sewer, poor sewer grades, or a need for periodic flushing or cleaning.

5. Check at manholes for excessive flows. This may indicate ground-water infiltration or storm-water, roof, or clear-water connections. The former will usually be found after a rain; the latter during or immediately after a rain.

6. Check manhole masonry to see if it needs repair, particularly above the frost line; manhole steps to see if they are sound; frame mounting on masonry; and seating of manhole covers. The grade of the cover may be raised, if necessary, to stop excessive surface water or earth from entering the sewer system. Blacktop pavement should not be laid over manhole covers; raise the grade of the covers to prevent this.

ELUTRIATION

HOW IT AIDS IN DEWATERING SLUDGE

A. L. GENTER
Consulting Engineer

SEWAGE sludges are mainly water, and a major problem in sludge disposal is the separation of the water from the solids. In sewage treatment, gravity settling of fresh domestic sewage containing 180 ppm. of settleable solids (5550 pounds of water to each pound of solids) produces a plain sedimentation sludge of 95% water and 5% solids (19 pounds of water to each pound of solids); and a vacuum filter cake, resulting from such a sludge, will contain 75% water and 25% solids (3 pounds of water to each pound of solids). The two latter ratios may be somewhat improved by digestion of the fresh solids and elutriation of the digested product. However, in any case, the smaller the fraction of water to be removed, the greater becomes the difficulty—and the cost per pound of water removed. This article will describe methods available for lessening the difficulty and reducing the cost.

Vacuum filters have 2,000 times the capacity of sand beds per unit of area, but, for most effective use, it is necessary to adapt the sludge to the limitations and abilities of the filter. Powerful chemical coagulants must be added to the sludge to make it more drainable and permit removal of as much water as is possible.

Chemical Requirements

It has been found that domestic sewage sludges have definite requirements for coagulating agents. Also, it has been found that the coagulant requirements for a fresh sludge are greatly increased by prolonged storage of the sludge in a digester, in septic tanks or even in pipe lines.

Practice has shown that the most efficient coagulating chemical is ferric chloride. Chlorinated copperas, ferric sulfate, alum and lime can be used but must be applied in larger amounts. Measured in terms of domestic sewage sludge, the largest chemical requirements are for fresh waste activated sludge of high volatile and water content, and the thin digested sludges derived therefrom. These will require, per 1,000 persons daily, 11 to 12 pounds of ferric chloride; and more of the other chemicals mentioned. The lowest chemical requirements are for highly mineralized (low volatile) well elutriated digested sludges, which require about 1 pound of ferric chloride per 1,000 persons daily. There are many variations between these extremes; and there are logical and easily explainable reasons for these variations.

Typical domestic sludges have both solids and liquid requirements for ferric chloride or any other coagulating chemical. The solids requirement is some function of the combustible organic (the volatile) matter in the wetted sludge solids. The liquid requirements are largely a function of certain biochemical end products dissolved in the free water present in the sludge. The solids requirements for coagulants predominate in sludges of high volatile content, as in all fresh sludges. The liquid requirements for coagulants predominate in digested and stale sludges. The total requirements for coagulant are the sum of solid and liquid requirements.

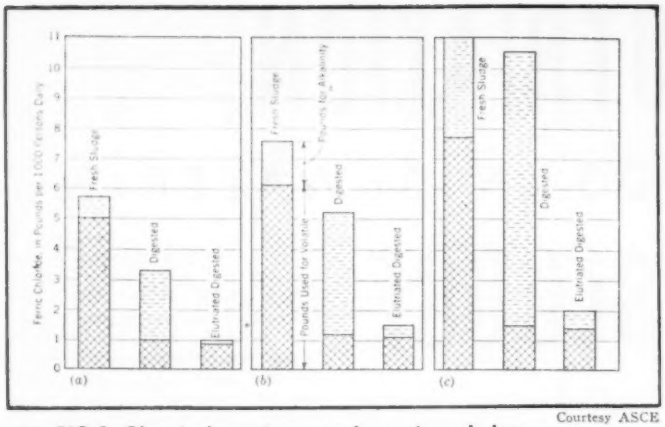
Changes During Digestion Process

A quite material part of the volatile or organic fraction of the sludge solids is destroyed during digestion, reducing the ratio of organic matter to mineral matter, and lowering the solids requirements for coagulant. However, digestion increases the ratio of water to the remaining solids in the sludge-water mixture; and it also produces biochemical end products that have a high coagulant demand. Ammonium bicarbonate has the leading role in this. Instances are quite common where the bicarbonates present in the free water of fresh raw sludges are increased sixty or more times during digestion of the solids. For example, a fresh sludge of 95% water, 5% solids and 100 ppm. alkalinity has but 0.18% alkalinity on solids present. Destroying half of these solids by digestion results in 97.5% water, 2.5% solids and 3,000 ppm. alkalinity, which amounts to 11.4% alkalinity on the digested solids remaining. This is sixty times greater than with the fresh sludge. If the alkalinity were 5,000 ppm. the increase would be about 100 times. Bringing the percentage of digested sludge solids back to 5% in this highly fouled sludge water of 3,000 ppm. alkalinity by thorough sedimentation and removal of supernatant liquor in a secondary digester, will reduce the alkalinity to one-half, or about 30 times its original value.

What Elutriation Is and Does

Elutriation reduces the coagulant demand of a sludge by improving the biochemical quality of the sludge water before chemicals are added. As the degree of chemical fouling resulting from digestion can be conveniently measured in terms of alkalinity, an elutriated sludge should be defined as one that has had the alkalinity of its biochemically fouled water reduced by dilution, sedimentation and decantation in water of lower alkalinity.

The use of sludge digestion in conjunction with elutriation combines to reduce chemical demand materially. In the first place, digestion materially decreases both the amount of solids to be dewatered and the chemical requirements of the mineralized residue. Elutriation then removes the biochemically fouled free water and reduces the ratio of the remaining sludge water to the mineralized sludge solids. Thus, the amount of solids to be handled, and both the solid and



Courtesy ASCE

● ***FIG 1. Chemical requirements for various sludges.***

liquid requirements for coagulant, are reduced with a marked decrease in the total chemical requirements for conditioning.

There are other advantages to elutriation as a preliminary to sludge dewatering on vacuum filters, including elimination of ammonia odors and the need for using lime in sludge conditioning. Elutriation may also reduce requirements for secondary digester capacity; and it is particularly helpful in permitting small plants to use vacuum filters to advantage.

Use With Vacuum Filters

An outstanding example of a small plant using elutriation advantageously is at Annapolis, Md. At the time this plant was equipped with elutriation it served less than 20,000 population. At present it serves more. Nevertheless it treats on a single vacuum filter unit of 65 sq. ft. area a year's sludge output during about 700 hours service, operating about 14 hours weekly or 8% of the total time. The chemical costs are about one-seventh of what they were before elutriation was used.

The bar graphs in Fig. 1 show where the chemicals go for various types of sludge. The amounts of chemical are indicated in pounds of ferric chloride per 1,000 persons daily. The calculations are for various types of sludge collected from separate sewerage systems handling domestic sewage at a flow rate of 80 gallons per capita daily. For combined systems additional allowances must be made.

Column (a) is for sludges from plain sedimentation treatment; (b) is for sludges from trickling filter and sedimentation treatment; and (c) is for activated sludge and sedimentation treatment. The cross hatched portion of all bars shows the chemical requirements for the sludge solids and the dashed portion shows the chemical requirements due to alkalinity. Where the percentage of alkalinity on solids is relatively low, most of the chemical is used for the solids requirements. The reverse is true with the unelutriated digested sludges in which, despite the good mineralization of the solids and reduction of the volatile-ash ratios, the high percentage of resulting liquid alkalinity makes this factor predominant in chemical requirements.

The graph in Fig. 1 (c) indicates that little, if anything, is gained in using vacuum filters without elutriation on digested mixed primary and waste activated sludges of excessive alkalinity.

Elutriation Methods and Equipment

There are three practical methods of washing sludge solids and the equipment used in all cases is relatively simple. It is simplest and least expensive with small installations where dewatering operations may be limited to 16 or 20 hours weekly.

Batch operated, single stage elutriation may be advisable. This is a fill-and-draw procedure which involves one-step dilution, sedimentation and decantation in a single tank. Two-stage elutriation involves repeating the single-stage steps on the elutriated sludge, using fresh water on the second wash. The same settling tank may be used for both stages in small plants. In plants serving over 30,000 population a second tank connected in series with the first is usually employed. Such a two-tank system can be used also for countercurrent washing. In this, the fresh water is added only to the second stage washing in the second tank and the decanted elutriate, or top water, from this tank flows by gravity to mix with the sludge flowing from the digester to the first tank. This method is best for continuous or semi-continuous operation because it produces the best results with the least total amount of water. It is recommended for installations producing two tons or more of digested solids per operating day where the removal of at least 85% of the alkalinity in one operation is of economic importance.

With plants serving less than 25,000 population, where the schedule of filter operations can be limited readily to 24 or 32 hours weekly, that is, 3 or 4 days of 7 or 8 hours, there will be ample time for washing the digested sludge a second time in the single batch tank, if high alkalinity removals are desired.

Equipment for Small Plants

Elutriation equipment for larger installations has been fully described elsewhere. This article deals with small plants involving a single elutriation tank adapted to fill-and-draw, batch operation. Where the vacuum filter may be operated but a few days weekly during 5 or 6 hours time the elutriation tank need not be operated concomitantly on a fill-and-draw basis.

Table 1 illustrates the basic design data for a single, batch operated, elutriation tank for two extreme types of treatment plants handling domestic sewage and serving 10,000 population with a daily average sewage flow of 1 mg.

Although Item 12 of the table shows that this layout is computed to operate but three days weekly, it may be operated four days weekly with thinner digested sludges than shown.. This will be advisable, where digestion is pushed at a high rate and the resulting strong digester supernatant is also run through the elutriation system in order to remove most of the suspended solids from it. This point will be subsequently commented on.

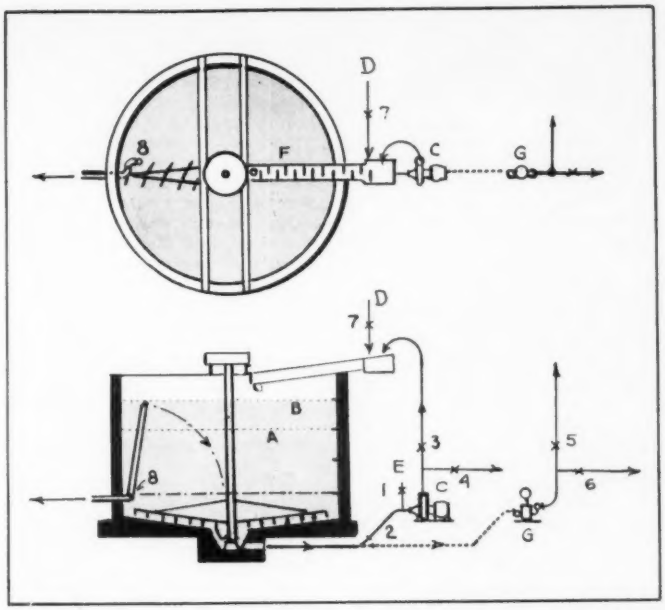
Fill-and-draw or batch elutriation consists either of adding separate batches of water and sludge to a tank in predetermined volumetric ratios, followed by mixing; or in mixing the water and sludge batches as they flow into the tank. In the

former case the tank serves as its own simple batch proportioning and metering equipment. In the latter the water and sludge volumes are metered as they flow into the tank.

In either case, after a tank is filled and mixed, sufficient time is allowed for thorough subsidence of the washed solids to a heavy sludge blanket. The relatively clear supernatant elutriate is then decanted from the blanket which may be then gradually pumped to the vacuum filter conditioning unit, or to sand beds or even back to the secondary digestion storage unit.

In the elutriation tank the drawoff level for removing supernatant elutriate is varied by means of draw off pipes placed at various heights in the tank wall; or by means of a jointed stand-pipe from the top of which short lengths are easily lifted as the liquid level recedes; or by a 90° ell and swivel connection. If a longitudinal tank is used, the supernatant drawoff level may be varied by removable weir boards.

A circular fill-and-draw tank designed to fit Items 14 to 20, inclusive, of Table I is shown herewith. It is 16 ft. in diameter and is equipped with a standard mechanically operated circular sludge collector. Items 17 and 18 of Table I should be measured by some fairly reliable method. A simple procedure is to equip the inside of the tank with rod markers imbedded in the concrete wall at definite depth intervals. Then the water may be run into the tank up to its volume marker, followed by the addition of the requisite volume of sludge from the digester which brings the total volume to the top marker.



● *FIG. 2. Circular fill-and-draw tank, items 14 to 20. Table 1.*

With batch operation the elutriated sludge is prepared prior to starting the vacuum filter. The schedule of operations involves: 1) dilution of the digested sludge with water; 2) mixing; 3) sedimentation of the washed solids; 4) decantation of the supernatant elutriate; and 5) feeding of the heavy elutriated sludge to the vacuum filter. The first three operations can be carried out at leisure in advance of filtration. Operation No. 4 may be carried out just prior to starting vacuum filtration. None of these operations requires the full time of an operator.

The wash water may be plant effluent or water from an adjacent stream or a well. It is run into the tank up to level A, Fig. 2. When level A is reached valve I is closed either automatically by float control or by hand. Then the digested sludge feed is started. With gravity feed the rate of flow may be regulated easily by a telescoping sludge control valve. With valve 3 open and valve 4 closed, the recirculating or mixing pump C is started at its maximum flow rate. Water is drawn from the bottom of the elutriation tank through line 2 and delivered to the inclined baffled mixing trough

TABLE I — BASIC DESIGN DATA FOR THE SMALL PLANT

Item	Treatment Method Used: Plain Sedimentation	Treatment Method Used: Complete Treatment
1. Ppm. suspended solids	240	240
2. Lbs. " " daily	2,000	2,000
3. Per cent removal	60	95
4. Lbs. removed daily	1,200	1,900
5. Lbs. " weekly	8,400	13,300
6. Per cent volatile in fresh sludge	72	70
7. Per cent volatile reduction in digestion	60	55
8. Per cent volatile in digested sludge	51	51
9. Per cent fresh solids left	57	57
10. Per cent solids in digested sludge	5	3
11. Lbs. digested solids weekly	4,800	7,600
12. Operating days weekly	3	3
13. Lbs. digested solids per operating day	1,600	2,533
14. Cubic feet digested sludge per operating day	500	1,330
15. Gallons " " " " "	3,750	10,000
16. Elutriation ratio (vols. water/vol. sludge)	3	3
17. Cu. ft. water per operating day @ 3/1 ratio	1,500	3,990
18. Cu. ft. sludge-water mix per operating day	2,000	5,320
19. Gallons of same	15,000	40,000
20. Elutriation tank dimensions from 18 or 19		
a) diameter in feet	16	26
b) wetted depth in feet	10	10
c) area in sq. ft.	200	532
21. Detention time in elutriation, hours	4	4
22. Per cent solids in elutriated sludge	8	6
VACUUM FILTER DATA FROM ABOVE		
23. Lbs. elutriated solids per operating day	1,440	2,280
24. Filter hours per operating day	5	5
25. Filter cake solids per hour	288	456
26. Cake yield, lbs./sq. ft./hourly	5	4
27. Sq. ft. filter area required	60	114
28. Nearest standard size	65	150
29. Drum dimensions, diameter and length	5' 3" x 4'	6' x 8'

F behind the inflowing digested sludge D.

The flow of the sludge from the digester is stopped when the marker for the total mix level is reached. Recirculation is continued long enough to insure a complete turnover of the tank contents. As before stated this time depends on the desired schedule and the capacity of the pump. This pump should be a clogless or free flow centrifugal that will not destroy the natural floc of the digested sludge.

As the total batch of sludge and water for an operating day's run amounts to 15,000 gallons (see Item 19, Table I) for the 16-ft. dia. tank, a pump capacity of 300 gpm means the turnover time would require 50 minutes after the tank has been first filled with 1500 cu. ft. of water. At a pump capacity of 200 gpm the turnover time would be an hour and a quarter. In order to have this time coordinated with the inflow of 500 cu. ft. (3750 gallons) of digested sludge, the feeding rate of the latter should be about 75 gpm in the former case and 50 gpm in the latter. However, in the absence of metering facilities, if the flow rate from the digester is less than either 75 or 50 gpm mixing is continued until mark B is reached. If the sludge flow rate is greater the flow is stopped when mark B is reached and recirculation continued until a complete turnover is accomplished. Then the solids are allowed to subside for at least three hours to insure a compacted sludge blanket.

With this intermittent fill-and-draw action, in which the mixture of sludge and water is allowed to come to rest, it will be found that the supernatant elutriate contains less suspended matter than with continuously operated tanks. After subsidence of the washed solids the elutriate is decanted from the tank and returned to primary sedimentation, if the BOD of this is higher than that of the plant influent. If it is lower, which usually will be the case, it may be transferred directly to the plant effluent.

As the pump used for recirculation mixing has a capacity some forty or fifty times greater than necessary for delivering the elutriated sludge to the vacuum filter and is of a type unsuited for delivering heavy sludge, a sludge pump should be provided. At the solids dewatering rates shown in Item 25 (288 and 456 lbs. hourly), and with the percentages of solids in the elutriated sludge (Item 22) this small pump transports but 7 gpm in the plain sedimentation plant and 15 gpm in the complete treatment plant.. The same pump can serve both installations, that is, an adjustable stroke and variable speed plunger pump, having a capacity variable from zero to 30 or 50 gpm, may be used.

Some filter manufacturers supply for small plants packaged filter units haivng a bucket elevator for feeding sludge to the small filter. Such elevators operate in a sump connected with the sludge line; and as they do not clog when handling heavy sludge, they are superior to plunger pumps.

When sludge is being drawn from the bottom of the elutriation tank the sludge collecting mechanism must be rotating. It should be kept still during elutriation settling.

Elutriation and Solids Balance

Referring to Items 13 and 23 of Table I it will be noticed that the weight of elutriated digested solids is tabulated as about 10% less than the weight of digested solids. This is typical of most elutriation installations and is primarily due to removal of soluble materials from the digested sludge during elutriation. This removal is normally beneficial. Furthermore in using lime together with ferric chloride as a coagulant on unelutriated digested sludges, it is a well known fact that the lime hydrate traps the carbon dioxide and bicarbonates in the digested sludge moisture, thus precipitating lime carbonate and other calcium compounds. In the case of the complete treatment plants, these lime compounds add as much as 40% to the weight of dry solids in a filter cake. This totals up to 50% more useless cake material than would result from elutriating the digested sludge and treating it with a small percentage of ferric chloride and no lime.

This brings up the subject of dosing elutriated sludges. Due to the fact that such sludges require no lime and relatively little ferric chloride, with short and thorough mixing, the writer does not favor using small plunger displacement pumps for ferric or other chemical feed and gearing such pumps to any elevator or pump feeding sludge to the mixer. This is particularly true of small installations employing so-called packaged sludge dewatering units. In such an installation the mixing chamber may hold but 15 gallons of sludge. If sludge pumping is interrupted for any reason, ferric feeding will likewise be interrupted if the ferric pump is geared to the sludge feeding pump. In starting sludge pumping again, the sludge stream will start ahead of the ferric feed which usually results in some unconditioned sludge flowing through the mixer to the vacuum filter pan.. There is nothing more reliable for small installations than a true volumetric solution feeder operating under a gravity head, electrically driven and with simple hand adjustment. Even in the largest elutriated sludge installations ferric feeding should be independent of sludge feeding.

Elutriation and Digestion Space

In the foregoing it was stated that elutriation is now becoming a popular method for treating dirty digester liquor and reducing secondary digestion space. Normally, in stage digestion, the primary digester is used for active digestion and gas production, while the secondary is used principally for: (1) permitting fluid digestion products drawn from the primary digester to cool; (2) stopping active digestion and gasification in order to permit the digested solids to settle; and (3) to take care of fluctuations in sludge disposal. A lot of relatively expensive space is generally set aside for this purpose. Even in such cases, there is little guarantee that relatively clear digester liquor will be returned to primary sedimentation from secondary digesters, especially in complete treatment plants.

When dirty digester liquor is returned to primary sedimentation, the settleable solids in it become elutriated in untreated sewage, lose their gas, settle in the primary sedimentation tank, and are returned to the digesters. These previously digested solids continue accumulating there for the full detention period, 25 days or more, and occupy valuable digestion space. The circulating load of digested solids flowing from the secondary digester back to the primary sedimentation unit, and again back to the digestion system, can at times result in a vicious circle wherein a chain of repetitions follow which aggravate the initial disorder in such a manner that more digested solids will circulate in the closed circuit in a year's time than will leave the plant in the filter cake. Increasing secondary digestion space is a very expensive cure for this trouble. It can be handled far more effectively at much less initial expenditure by single-stage elutriation. The concentrating action in a single stage elutriation tank will, in three or four hours time, do better work than can be

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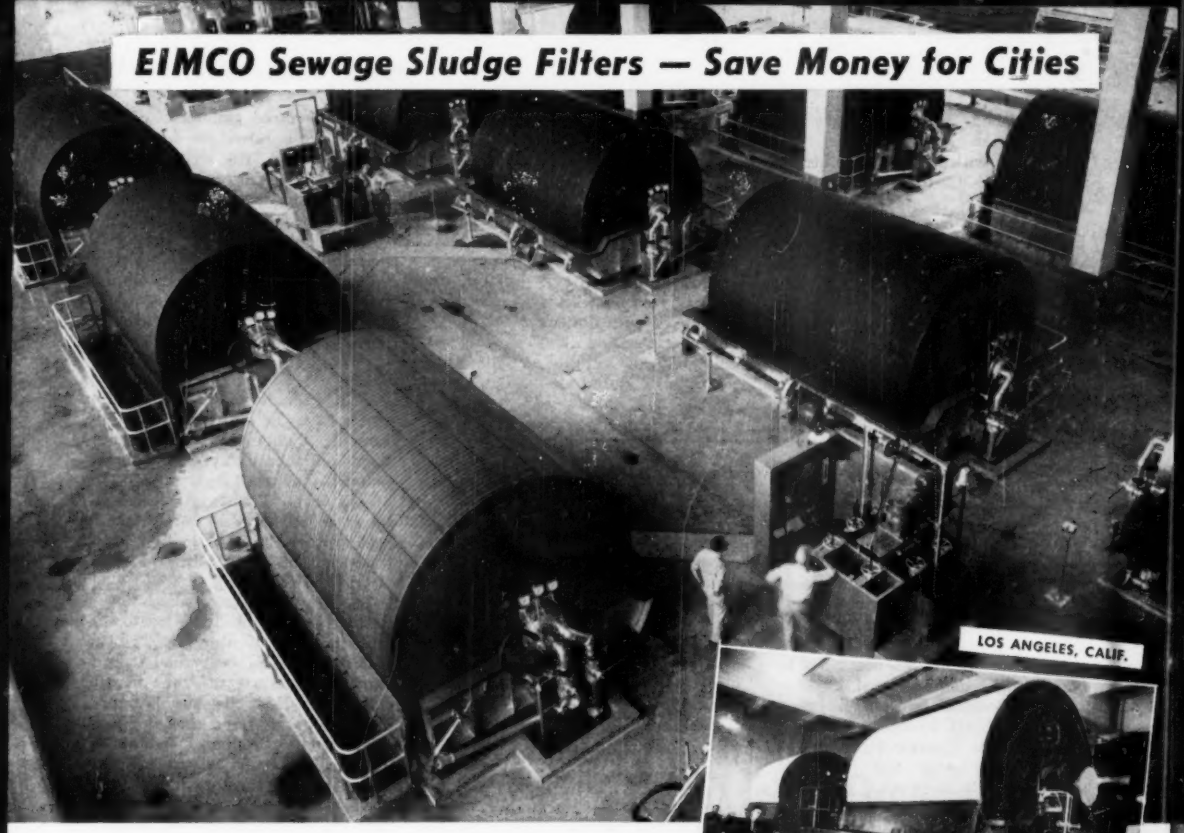

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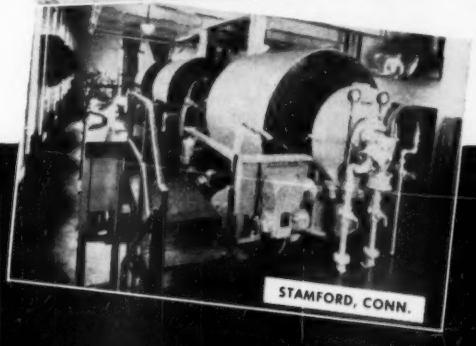

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accomplished in a secondary digester in ten day's time; and incidentally it will produce an elutriate of lower BOD than the digester supernatant.

The single stage elutriation tanks herein recommended may be conveniently used for clarification of the digester supernatant. This is diluted and mixed with elutriating water and allowed to settle. The relatively clear elutriate is decanted back to primary sedimentation and the concentrated product either held for the next sludge elutriation batch or pumped back to secondary storage for further solids concentration and general alkalinity reduction, as desired.

In following this latter procedure with the sludges listed in Table I, where the digested sludge contains about 50% volatile matter, the secondary storage tank should be equipped either with a steep hopper bottom or with a mechanical sludge collector. Washed digested sludge of relatively low volatile contents may result in a stored sludge having as high as 20% solids.

Laboratory Demonstration of Elutriation

The advantages of elutriation may be computed from the analyses of the sludge, that is, the percentages of water, solids, volatile matter and ash, and the ppm alkalinity of the sludge and water used for elutriation. Also, these benefits may be convincingly demonstrated by elutriation, coagulation and filtration tests conducted in the laboratory. The resulting filtration tests may be graphically plotted and compared with similarly conducted tests on the original sample of unelutriated digested sludge.

By proper elutriation, the laboratory equipment needed consists of a 16 or 20-liter flask; a length of glass tubing of about ½-inch bore, somewhat longer than the depth of the flask, and having an elbow bend at one end with rubber tubing long enough to siphon off the elutriate; and an ample supply of either tap water or the water to be used for elutriation. If this is plant effluent, it should be fresh.

For filtering, one requires a laboratory tap aspirator of ample capacity and capable of producing a 28-inch vacuum at sea level; a few feet of ¼-inch bore, thick walled rubber suction tubing, a glass tee to fit same; either a standard dial vacuum gauge or a home made mercury column gauge; one or two one-liter filter flasks; one or two 9-centimeter diameter Buechner funnels with stopper to fit same and the filter flask; a stop-cock for the vacuum line; one or two low form beakers of 400 or 500 milliters capacity; a small hard rubber or stainless steel spatula; a pulp balance, accurate to 0.1 gram; a supply of 9 cm. diameter, No. 4 grade Whatman filter papers or, in lieu of these, one or two 9 cm. diameter disks of the filter cloth used on the actual plant vacuum filter; about a liter of ferric chloride solution of known concentration (approximately 0.1 gram per ml.); one 10 ml. pipette calibrated in milliliters and one-tenth milliliters; one 2 milliliter pipette likewise calibrated; and either a stop watch or an electric clock with a second hand for timing each test. The setup of the filtration equipment is indicated herewith.

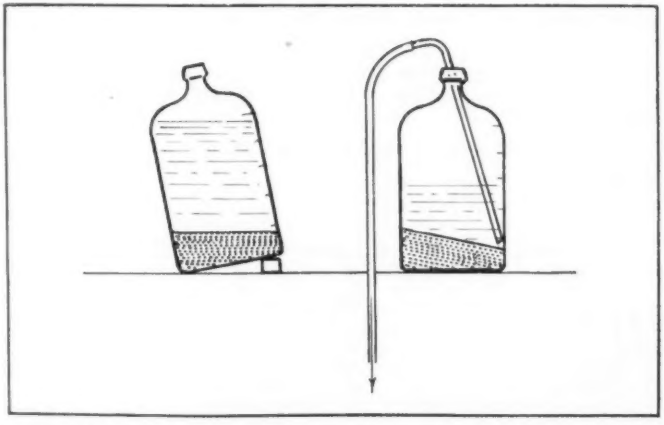
Procedure in Tests

Before elutriating a sludge sample, the flask is calibrated in order to save time in elutriation operations. If this flask is of 16-liter capacity, pour three liters of water into it and mark the level on the outside of the flask. This is the original digested sludge level. Then repeat the 3-liter additions and markings four more times thus showing 3, 6, 9, 12 and 15-liter levels. This permits washing three liters of sludge at four different ratios.

Two or three gallons of digested sludge are required for comparative filtration tests. The writer runs the filtration tests on the unelutriated portion while a three-liter sample of the identical sludge is being elutriated. This procedure is preferable because the unelutriated sample will lose considerable ammonium bicarbonate in standing around a day or so. However, in the following, the elutriation procedure with its filtration tests will be described first.

After removing the calibrating water from the elutriation flask, the sample of digested sludge should be mixed thoroughly and a portion poured into the flask up to the 3-liter level. Then elutriating water is added until the total contents reach either the 12 or 15-liter mark, depending on the washing ratio desired for testing.

The flask is then stoppered, turned on its side and gently rolled to mix the contents thoroughly. Violent agitation should be avoided to prevent destruction of the natural sludge floc. Next the flask is tipped, the stopper removed and the flask supported so it remains tilted somewhat from the vertical and with the 3-liter marker in the higher position. Within two or three hours time the washed solids will usually settle back to a horizontal level with one edge of the sludge blanket somewhat below the original 3 liter marker. Then the elutriate is siphoned from above the sludge blanket with the large bore glass tube and rubber tubing. The glass tube should be long enough to permit manipulating its submerged end against the inside of the flask where it is easily visible above the sludge



● ***FIGS. 3 & 4, showing how flasks are handled for the test.***

blanket, in order to prevent sucking sludge into the tube. When about half of the elutriate is removed and while siphoning continues, the tilting support should be removed from under the flask and the flask gently lowered to its vertical position. The sludge blanket will remain tilted, and the remainder of the elutriate may be siphoned from above the blanket. If the 3-liter sample is to be given a second wash, the foregoing operations may be repeated. It will be found in such a case that the solids settle somewhat faster, especially if the original sample contained sludge moisture of high alkalinity.

When the supernatant elutriate has been completely siphoned from the washed sludge a sample of same is taken for pH and alkalinity determinations. The remaining three liters of sludge, or somewhat less, depending on the solids content of the original sludge sample, should be well mixed and poured into a container from which a sample can be taken for the determination of solids percentage, volatile content, etc.

The filtration procedure consists in running a series of at least five tests on successive 200-gram samples of the sludge. As before noted the unelutriated samples should be run first. Each 200-gram sample is given a different dose of ferric chloride solution of known strength (approximately 100 grams ferric chloride per liter, or 0.1 gram per ml.) and the time required for complete drainage of the 200-gram sample is clocked in minutes and seconds. The timing starts just after the properly weighed and dosed 200-gram sample is poured and scraped into the Buechner with its wetted filter paper or cloth. The finishing time is clocked when the filter cake in the Buechner becomes dry enough to contract and separate from the wall of the Buechner, thus allowing air to be drawn into the filter flask. This time becomes evident by a rather sudden drop of the vacuum gauge indicator. The longest allowable filtration time should be six minutes for the minimum dose. Continuous filters are rarely revolved at speeds much slower than six minutes per revolution or ten revolutions per hour. With 5% or 6% solids in a sludge (11 or 12 grams of dry solids in each 200-gram sample) at the optimum dose, the vacuum break will take less than a minute on elutriated sludges and somewhat more than a minute on most unelutriated digested sludges.

All 200-gram samples may be quickly weighed on the pan balance by taring a 400-ml beaker in the following manner. First weigh in the beaker 200 grams of sludge and mark the sludge level on the outside of the beaker. Then pour out the contents and scrape most of the remainder from the beaker wall and bottom and tare the scraped beaker. Thereafter in weighing each 200-gram sample a 200-gram weight is placed on the weight pan and sludge is quickly poured into the wetted beaker to near the exterior mark. Then with a spatula enough sludge is quickly added to bring the weight to 200 grams.

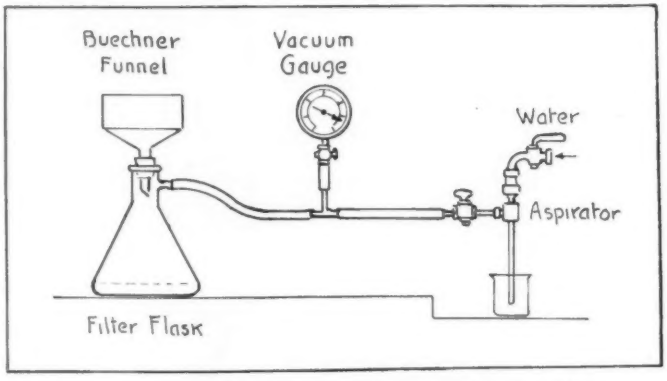
In order to keep the total volume of filtrate fairly constant notwithstanding the varying quantities of ferric chloride solution added in successive tests, the author adds a 20-gram weight to the 200-gram weight, then adds his determined amount of ferric chloride solution from a pipette, and brings the total to 220 grams by adding distilled water to make up the difference. This 20-gram limit above the 200-gram sludge weight permits adding a wide range of ferric chloride doses when using a 10% ferric chloride solution without changing the amount of filtrate per gram of cake solids in all samples.

With elutriated sludge, after adding the predetermined amount of coagulant and hastily balancing the beaker with distilled water, the beaker is removed from the balance and the contents thoroughly but gently stirred with the spatula for one minute. The contents of the beaker are then poured into the Buechner funnel, wherein a wetted filter paper has been previously sucked into position on a spare filter flask. The coagulated sludge adhering to the beaker walls and bottom is scraped into the Buechner and the contents of the latter gently jarred as level as possible. The empty beaker is returned to the balance and the 20-gram weight removed from the weight pan. The vacuum control cock is then opened simultaneously with starting the stop watch, or when the second hand of an electric clock reaches a definite minute. The time it takes to evacuate the filter flask and produce a high vacuum will be constant for all tests and will take but a few seconds with a good aspirator and tight connections. The time elapsing between filtration start and vacuum break is recorded both in minutes and seconds and minutes and decimals of a minute.

While the sample is filtering there is usually time for seeing if the wet beaker balances with its tare. The 200-gram weight may then be added to the weight pan and a new 200 grams of sludge is weighed and the 20-gram excess weight added preparatory to making the next filtration test.

As before stated samples of the batches of sludge before and after elutriation are taken out for determinations of solids, moisture, volatile matter and alkalinity. These basic data are accepted as the average of all samples coagulated and filtered. The analytical data are finally inserted in the descriptive heading for each series of tests as shown in Table II. The percentages of ferric chloride used on the dry cake solids in each 200-gram sample have to be tabulated after the analytical data are obtained.

When the ferric dose is too low filtration time will exceed six minutes and the pH of the filtrate will in all probability exceed 7. As previously stated such tests should be discontinued and the Buechner



● *FIG. 5. Set-up for laboratory sludge filtration procedure.*

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TABLE 2 — DETERMINING FERRIC CHLORIDE REQUIREMENTS

Testing Unelutriated Sludge

Type of sludge—digested primary; per cent water, 94.5; per cent solids, 5.5; alkalinity, 3,500 ppm; per cent volatile, 56.5; grams of solids in 200-gram sludge sample, 11; ferric chloride solution, 0.1 gram per ml.

Ml.	ferric chloride grams.	% on solids	time min.	filter rate gpm.	filtrate pH
3	0.3	2.7	3.0	3.7	7.0
4	0.4	3.6	2.33	4.7	6.8
6	0.6	5.5	1.75	6.3	6.4
8	0.8	7.3	1.33	8.3	6.0
10	1.0	9.1	1.1	10.0	5.6
11	1.1	10.0	1.05	10.5	5.3
13	1.3	11.8	1.05	10.5	5.0

Testing Elutriated Sludge

Type of sludge—digested primary, elutriated twice at 3 of water to 1 of sludge; per cent water, 94.5; per cent solids, 5.5; alkalinity, 220 ppm; per cent volatile, 55; grams solids in each 200-gram sludge sample, 11; ferric chloride solution, 0.1 gram per ml.

Ml.	ferric chloride grams.	% on solids	time min.	filter rate gpm.	filtrate pH
0.5	0.05	0.45	3.0	3.7	7.0
1.0	0.10	0.90	1.5	7.3	6.6
1.5	0.15	1.35	0.93	11.7	6.2
2.0	0.20	1.80	0.70	15.7	6.1
3.0	0.30	2.70	0.50	22.0	5.4
3.5	0.35	3.20	0.47	23.4	5.2

cleaned. Another test at a somewhat higher dose should be started. When the pH of the filtrate of any specific test drops well below the value of 6, as one may be assured that larger doses add little or nothing to filter yields and obviously waste chemical.

As previously stated one should run the tests on the unelutriated sludge first, while a three-liter sample of the same sludge batch is being elutriated. In practice, unelutriated sludges dosed with ferric chloride alone, or with lime and ferric chloride, have to be stirred several minutes longer than do the elutriated sludges. Adding ferric chloride alone to unelutriated digested sludge evolves copious quantities of carbon dioxide gas which causes voluminous foaming of the 200-gram sample. If the gas is not thoroughly stirred out of the sample before pouring it into the Buechner, the resulting cake will be so foamy and sloppy that a faulty and premature vacuum break will occur. Upon adding the ferric and distilled water to such sludge samples and starting stirring the gas evolution will materially increase the sludge volume. Stirring should be continued until the sludge volume shrinks back to near its normal value in the beaker. Then the resulting filter cake in the Buechner will be compact and free from sloppy foam.

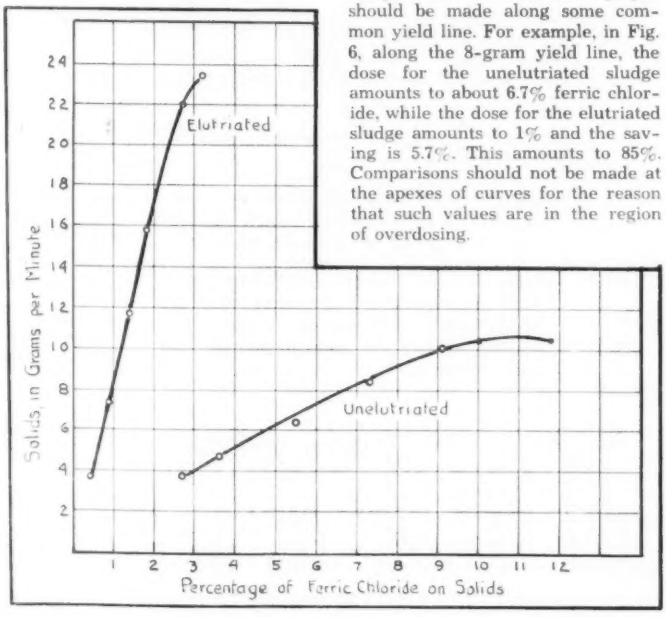
When lime and ferric chloride are used on elutriated sludge they are generally used in proportions of approximately three or four times as much CaO as $FeCl_3$. The former is made up as milk of lime containing about 100 g. per liter. It is generally added first and stirred for two or three minutes in order to precipitate the bicarbonates, carbonates, etc., as lime carbonate. Then the ferric chloride solution is added and stirred into the sludge for another minute or so. The amount of lime used should be such that there will be no gas evolution when the ferric chloride is added. Lime is not used with elutriated sludge.

Plotting Graphs

The graphs depicting the use of lime and ferric chloride may be made in either of two different ways. Combinations of both at various doses may be shown on one graph; or the lime may be figured in cost equivalent terms of the ferric chloride and added to the ferric chloride dose. For example with lime costing $12 per ton of available CaO and ferric chloride costing $72 per anhydrous ton, each per cent of lime added amounts to one-sixth of a per cent of ferric chloride. In adding to a digested sludge 3% ferric chloride and 12% lime the total addition in terms of ferric chloride alone amounts to 3 + 2 = 5%.

In dosing fairly well elutriated sludge samples, it will be noticed that there is little or no gas evolution when the ferric solution is added and materially less stirring is required completely to flocculate the 200-gram sample.

After the complete tabulation of the data on all tests, as illustrated in Table II, the results are graphed for comparison. In estimating the chemical saving resulting from any particular elutriation procedure the comparisons of the two graphs should be made along some common yield line. For example, in Fig. 6, along the 8-gram yield line, the dose for the unelutriated sludge amounts to about 6.7% ferric chloride, while the dose for the elutriated sludge amounts to 1% and the saving is 5.7%. This amounts to 85%. Comparisons should not be made at the apexes of curves for the reason that such values are in the region of overdosing.



● ***FIG. 6. Method of plotting ferric chloride-solids percentages.***

BETTER BASES MADE BY STABILIZING WITH CALCIUM CHLORIDE

T. D. WILLIAMS,
County Engineer,
Knoxville, Tennessee

Portions of a paper presented at the recent American Road Builders' Association meeting.

OUTSIDE of the city limits of Knoxville and excluding the State Highway System, Knox County has over 1800 miles of roads. Of these, approximately 400 miles are surfaced roads in good condition, 400 miles need resurfacing, and the balance are macadam roads, 60% of which should be surfaced immediately. Recently we prepared an estimate of the cost necessary to put our county roads and bridges in the shape the people would like to have them. This estimate ran in the neighborhood of $10,000,000. With the county's assessed valuation and a reasonable tax rate, an improvement program of this capacity would have to extend over quite a period of years.

We are constructing crushed stone stabilized bases with calcium chloride added. Knox County is extremely fortunate in having an unlimited supply of limestone formation that can cheaply and readily be crushed into aggregates well suited for all types of road construction. We operate six county quarries located centrally in our six maintenance divisions and crush the majority of stone used in both our construction and maintenance work. Naturally this crushed stone is angular in structure and possesses a good cementation quality, thus giving a good interlocking base.

The average road that we are stabilizing and surfacing is an old macadam road where stone has been added periodically and often spasmodically over many years. It is impossible to determine how many cubic yards of stone have been added to the roadway in this manner, but the majority of this material has been lost. Our borings

show that we can depend on only two inches of existing material that can be used in the future base. If this material is of uniform depth, adequate width and well enough stabilized, the next lift of base material is placed directly upon it. Otherwise it is necessary to scarify the existing macadam, add material as necessary, and reshape to proper depth, width, and crown before rolling and subsequently adding the final lift.

Aggregate Gradations

We have experimented with several types of bases using a variety of different aggregate gradations in order to determine that best suited for our high-type, low-cost county road. Although our experiments have not been extensive, they have proven in our own minds that the type base recently adopted is by far the best and most economical method of solving our problem. As a result of our experience, we have adopted as our specifications on graded aggregate for bases, the mix shown in the table.

The last column in the table gives a gradation being used at present. It may appear that there is too little material passing the No. 200 sieve.

Sieve No.	Per Cent Passing	
	Specifications	Used
1"	100	100
¾"	80-100	95
⅜"	50- 90	77
No. 4	36- 65	61
No. 10	22- 50	38
No. 40	15- 30	16
No. 200	5- 15	5

We, too, believe this to be true but if construction costs are to be kept at a minimum, local materials must be used. We find that by using our own materials, we can combine approximately 60% of crusher run stone (stone not screened) and 40% limestone dust (obtained when the crusher screens are installed to produce oil stone) and arrive at this gradation. To obtain a more suitable gradation, additional binder soil would have to be obtained and we find this to be impractical.

Base Construction Procedure

1. Coarse aggregates are spread on the roadway—preferably by mechanical means, such as tail gate spreaders or spreader boxes. This operation should be rigidly controlled by placing a checker on the roadway to control the dumping distance. This material, unless evenly distributed, should be leveled by means of a patrol grader.

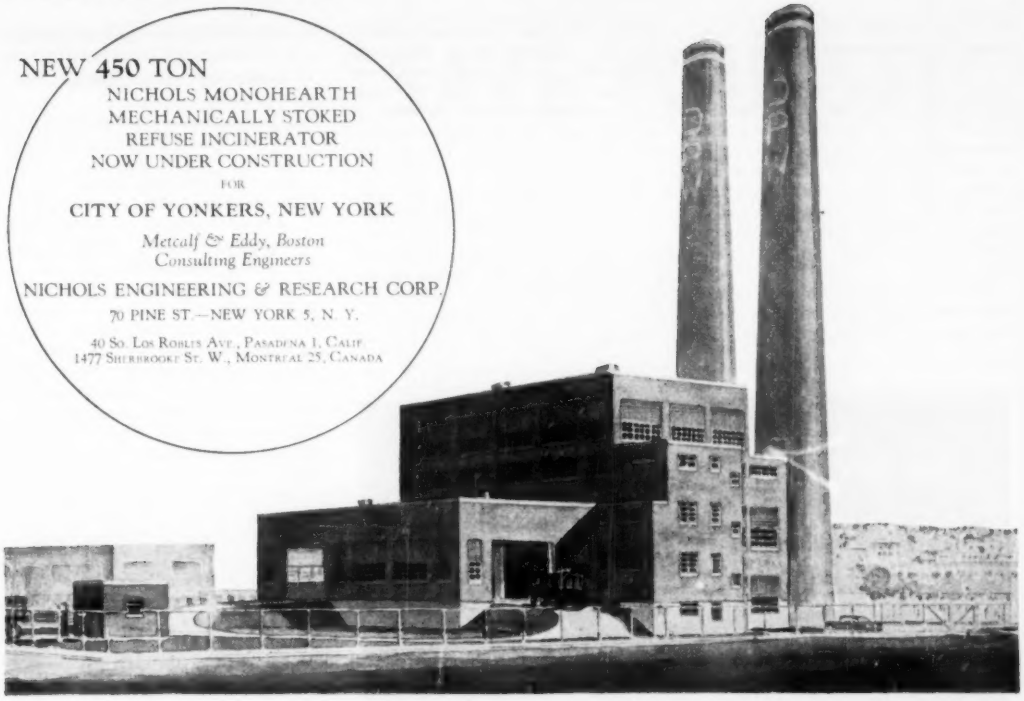
2. Limestone dust is added on top of the coarse aggregate in a similar manner.

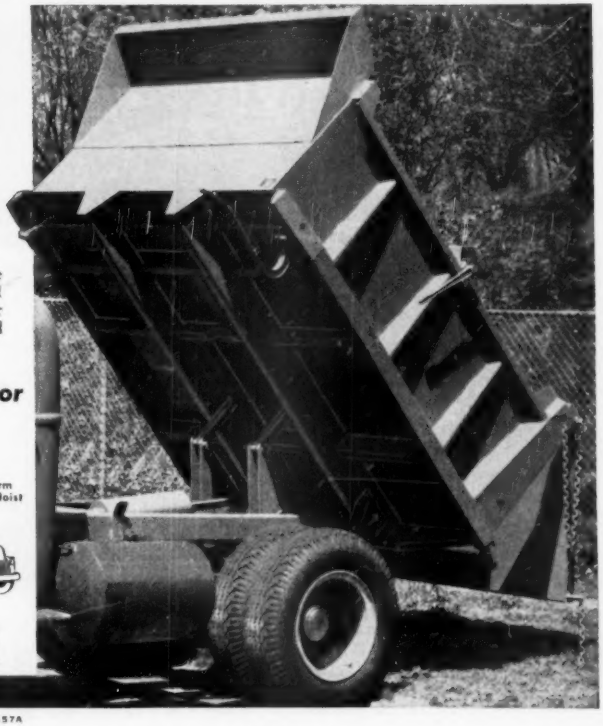
3. After a minimum of one-half mile and a maximum of one mile of aggregate has been placed, calcium chloride is added at the uniform rate of one pound per square yard per three inches of lift.

4. The material is then bladed by standard methods from side to side with a patrol grader until it is uniformly mixed. Water must be added at the beginning and, if necessary, throughout the operation. Experience alone can teach one the correct amount of water to be added.

5. After the material is properly mixed, it should be windrowed and left to cure. This curing, depending upon temperature and weather conditions, normally requires two days. Mixing operations can proceed at another section of the project during this curing period.

6. After curing is complete, the material should again be bladed to insure that no segregation has taken place; and then leveled to the proper grade and crown. Rollers, preferably





8 to 10-ton three-wheel, can then complete the operation.

7. When this operation has been completed, the base again should be allowed to cure before adding the second lift; or, in the event this second lift is not needed, before the surface is primed. Normally, when calcium chloride is used, watering during this curing period is not required. However, it is extremely important to insure against drying out too fast.

The use of calcium chloride in our bases has been discussed at great lengths in our organization. To satisfy ourselves, we placed several stretches of base using the same aggregates, some with and some without calcium chloride. Our findings plainly show that the calcium chloride base is definitely desirable and the most economical in the end.

Among its advantages are:

1. Density of the completed base was found to be much greater and this density was obtained by approximately half the rolling necessary in the bases constructed without the use of calcium chloride. This in turn made it possible to do twice as much work with our rollers.

2. Considerably less watering was necessary, especially in the hot summer months.

3. Aggregates mixed more readily. It was found that approximately two-thirds the blading for proper mixing is necessary when calcium chloride is used. This is undoubtedly due to the ease of maintaining the proper moisture content during the mixing operations.

4. It is important in obtaining a good base to keep the material from drying out too quickly. When calcium chloride was not used, it was found necessary in the summer months to water the rolled base for several days in order to prevent this condition. No watering was required when calcium chloride was used.

5. One of the most important advantages is found when it is impractical to surface the base within several months. Last summer we had over twenty miles of base completed early in the season and found it necessary to leave it without even a prime coat for from two to five months, through hot dry weather. In those bases not treated with calcium chloride, so many pot-holes and corrugations developed that in all cases it was necessary to scarify, reblade, and reroll the surface before priming. In several locations fines had to be added. In those bases where calcium chloride was used, no corrugations occurred and relatively few pot-holes were found. The holes were readily filled with pre-mix material and very little blading was necessary prior to priming. One such test section was completed last August and we purposely left the top unsealed. This section, six months since completion, has withstood the dry weather of late summer and the winter months that have been exceedingly wet (over 9 inches of rainfall in January) with practically no deterioration at all. In fact, it could be primed now without any repair work being done. The roadway section must have an adequate crown, preferably not less than 3 inches for an 18-foot surface so as to provide adequate surface drainage.

6. Undoubtedly considerable benefit is derived through frost prevention. We have not made tests concerning this; but the bases have stood up very well in freezing weather; also, they are relatively dust-free; and they have carried our traffic loads with a minimum of maintenance.

Radio Communications In Water Works

J. G. COPLEY
General Manager,
Elmira, N. Y., Water Board

THE Elmira Water Board Radio Communications System consists of a Central Station, KEA-319, with Motorola FSTRU-50 BY (A) Unit, operating on a frequency of 153.71 megacycles, under authority of license issued by the Federal Communications Commission.

The Central Station is located at our filtration plant, where we have twenty-four hour operation. There is in addition a Remote Control Unit located in our maintenance shop and garage, which enables the men on duty at this station to act as radio operators during the day, when the building is in use. The range of our central station is thirteen miles.

Our mobile units consist of a Motorola FM two-way Radio Telephone "Dispatcher." Mobile units have been installed in our Meter Department emergency truck; in the emergency trucks of our Maintenance & Construction Department, and in the truck of our maintenance and construction foreman.

How Time Is Saved

Under our normal peace time operation the unit has been extremely successful in eliminating lost time and travel from our shop to the various construction jobs, and also in eliminating delays in making meter installations and removals and emergency shut-offs. The use of the mobile unit by our Meter Department consists of calls to the Central Station for meter installations or removals before leaving any particular territory. In this way we are often able to make immediate installations or removals of meters without the backtracking of the meter department truck, thus eliminating a great deal of mileage and lost time.

In our Maintenance & Construction Department the units have proved invaluable, in that they provide immediate contact with our shop, so that needed material or equipment may be transported to a job immediately. The unit also enables our foreman to keep close track of the progress of work in various sections of the City without having to travel to them, and

enables him to shift men from completed jobs without lost time.

The units of course have proved their value most spectacularly in the handling of emergency shut-downs of mains because of breaks in either mains or services. Oftentimes the central station has been able to transmit calls for these shut-downs to trucks in the immediate vicinity of the trouble, and has saved considerable damage that would otherwise have been caused by running water, in the time required to get trucks to the job from our maintenance shop.

While these units have proved extremely valuable in peace time operation, they will be practically indispensable under the rapidly developing Civilian Defense Program. We have been assured by our local Civilian Defense Command that our own communications system will be permitted to operate in emergency service. Having experienced the difficulties of communicating with emergency units during black-out tests in civilian defense exercises during the last period of their activities, we can see where it will enable us to reach emergency areas a great deal quicker than was possible before. Also it will be possible to receive reports of damage in such areas and make arrangements for prompt repairs and shut-downs when mains may be broken. In such emergencies it is always possible that normal methods of communication may be interrupted, and with the radio control from Filter Plant or Maintenance Shop on the outskirts of the city, it will still be possible to maintain our emergency services in effective operation.

Cost Data

Questions have been raised as to cost of installation and maintenance costs of such equipment. The approximate cost of installation of our Central Station was $830 and it cost approximately $425 per unit for the installation of each mobile unit in our various trucks. We are fortunate in having expert maintenance of these units available on the basis of a contract charge. That charge is $8 per unit per month, which covers all parts and equipment, and the checking of all units each month.

An additional item that we have found advisable on some of our trucks is the installation of a high capacity alternator in place of the generator. When trucks are standing on a job we often leave the radio turned on so that calls may be received. The alternator, which has a solid core with no winding to burn out, produces A.C. current at 110 volts, which is rectified to D. C. current at 6 volts and 80 amperes. The alternator will produce full 80 amperes at an engine speed of only fifteen miles per hour, whereas the ordinary generator requires thirty-five to forty miles per hour to produce a current of 35 amperes. When an alternator is used the cost per truck is increased by $250.

The original decision to install the communications system was taken because of the knowledge that other utilities and transportation companies in our area were planning to install radio communication, and the Elmira Water Board desired to have available a clear channel for its communications. It is possible to obtain licensing for a Central Station and one or two mobile units, which thus reserves a channel for emergencies for the particular utility making application to the FCC.

This article is from *Water Works News*, published by the New York State Department of Health.

PUBLIC WORKS DIGESTS

THIS section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

THE WATER WORKS DIGEST

Metering Multiple Dwellings

In a panel discussion of this subject, experiences were given by managers or engineers of the Washington Suburban Sanitary Dist., Miami, Fla., Newark, N. J., Omaha, Neb., Louisville, Ky., and Toledo. The general practice is to furnish water to multiple dwellings—large rooming houses, apartment buildings, housing units containing 6 or more full-size family apartments and hotels—through one meter located where the water enters the premises, and the owner pays for the water that passes this meter. However, Miami meters individual families if desired. Most owners report little trouble with excessive waste by tenants, except in the few cases where the relations between owner and tenants are not friendly. A few owners meter the supplies to individual families; most think the possible saving in their water bill would not compensate for the extra cost of plumbing and meters and of maintaining same.

Harry B. Shaw, W. A. Glass, Wm. G. Banks, John C. Detweiler, B. E. Payne and George J. Van Dorp —"Management Experience with Metering Multiple Dwellings;" *Journal American Water Works Ass'n*, October.

Charges for Private Fire Service

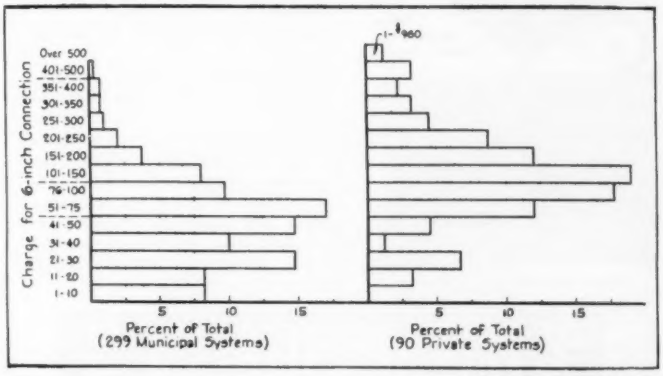
Returns from a survey show that 56% of municipal water systems levy no charge for private fire service connections. Of the 44% which do, 57% charge $50 or less a year for a 6" connection, and a small percentage $200 to $500. Many rates are predicated, not on size of connection, but on number of sprinkler heads, on floor area protected, or on a flat charge. Since it is highly improbable that sprinklers over more than 5,000 sq. ft. of floor area will open for any given fire, there seems to be no logic in charging on the basis of number of sprinklers or floor area.

The water utility is paid for general fire protection by either the tax payers or water users or both. Those having private fire service connections therefore pay for the general fire protection; and if they also pay for private sprinkler service they are charged twice for protection. It may be assumed that they receive additional protection but this is paid for by themselves in the installation of sprinkler systems. No more water is used for protecting such properties; in fact, figures collected by the National Fire Protection and Factory Mutual associations apparently prove that the water demand in sprinklered properties is but a small portion of that which is used to fight fires in unsprinklered properties of the same class of occupancies. Records show only 1% of fires in sprinklered properties had required 2,000 gpm or more, but this amount was required by 60% of fires in unsprinklered properties. A rebate to sprinklered properties would seem to be more logical than an additional charge.

Richard H. Ellis—"Charges for Private Fire Protection Service;" *Water & Sewage Works*, November.

Preventing Pipe Line Freezing

When the temperature of water in a main falls below 32° F by as much as 0.01° to 0.10°, frazil ice forms, may collect into slush and freeze into a solid mass. The shattering stress of solid ice, which may burst the containing pipe, is about 400



Courtesy Water & Sewage Works

● *ANNUAL charges for 6" private fire connection.*

psi. The warmer the water as it enters the pipes, the longer time (or distance) before it freezes. Water at the bottom of a deep reservoir or lake seldom falls below 39° F. The larger the pipe, the longer it takes the temperature of contained water to fall 1°. Heat is transferred through the pipe wall at rates depending on the material. If we call the rate through wood stave pipe 2″ thick, as 1, the rate through 5″ concrete is about 2, through 1″ asbestos cement 9, through 0.75″ cast iron 1,000 and through 0.25″ steel 2300. The water is heated by the friction of flow through the pipe, inappreciably in the case of slow flow through large pipe, but appreciably by rapid flow in small pipe. There are four ways to prevent freezing: Withdraw the warmest water possible from the lowest strata of a reservoir; provide a high velocity in the pipeline (a short detention period); blow off water to waste at the end of the line to decrease the detention period; and check heat loss by insulation. Wasting water may be inadvisable except under emergency conditions, particularly if water is treated before transmission.—Use of wood or a highly porous glass for insulation seems economically feasible. If the pipe could be inclosed to provide a dead air space around it, then freezing is practically impossible even under the most severe conditions.

Thomas M. Riddick—"How to Prevent Pipeline Freezing;" *Engineering News-Record*, Nov. 9.

Applying Activated Carbon to Orange Reservoir

Part of the supply for Orange, N. J., comes from an impounding reservoir with a capacity of 271,000,000 gal. This reservoir furnishes between 1.5 and 2.0 mgd, and 1.5 mgd is obtained from wells, this being the limit set by State control. In 1947 algae in the reservoir produced vile odors, and it was decided to use activated carbon to eliminate them. As the well water did not need treatment and was mixed with the reservoir supply before it reached the treatment plant, the carbon was supplied directly to the reservoir. For this purpose, a boat with an outboard motor was fitted with a 50 gal. steel drum and a 15 gpm centrifugal pump, with the necessary pipes and valves. Water from the lake is pumped into the drum, powdered carbon is dumped into it and kept stirred by hand while, by operating valves, the pump discharges the carbon slurry over the surface of the lake. The first treatment was by 400 lb. of carbon to an estimated 170,000,000 gal. of water; preceded two days previous by copper sulfate treatment. This destroyed most of the algae and of the odor. The carbon treatment now is given at about 4-week intervals from early spring to late fall, always preceded by copper sulfate treatment; but is made at 10-day intervals during hot, sunny or dry weather. This entirely eliminates taste and odor complaints.

Fred Luthy—"Powdered Activated Carbon Application to Orange Reservoir;" *Taste and Odor Control Journal*, September.

Filtration Plant For Chapel Hill

Chapel Hill, N. C., uses about 1,200,000 gpd for supplying its 15,000 population. This water is derived from a lake whose watershed is calculated to have a dependable yield of 6 mgd. But its old treatment plant could, by operating 24 hr. a day, produce only 1,400,000 gpd. which was 100,000 to 350,000 gal. below the peak demand. The city

has recently installed a new plant with filters having a capacity of 3 mgd and flocculating equipment for 6 mgd. There are three 1 mgd filters, with Wheeler bottoms and Palmer filter sweeps. A flocculation basin has three sets of 2-paddle Dorr flocculators, with 45 min. mixing time and 5 hr. settling time. A clear water basin has a capacity of 1,500,000 gal. Two 3 mgd raw water pumps at the lake lift the water 160 ft. to the filtration plant, and three high-lift pumps have a capacity of 8 mgd. There is no stand-by equipment, for it is operated by a State-owned power plant and in addition has an arrangement for standby service with the Duke Power Co., which has multiple cross-connections. To give a favorable impression to visitors, green is the predominant color of the building's interior, and beautification of the exterior by landscaping is underway and abundant parking space is available.

J. L. Morrison—"A Model Filtration Plant for a Problem Town;" PUBLIC WORKS, November.

Recording Customer Consumption

Essex Fells, N. J., being troubled with complaints of high bills, obtained a "Meter Master", which records by graphs the rate at which water passes through a service meter. In due time all complainers were satisfied that their meters were reliable. Then it was decided to check practically all of the meters in the community, with the surprising discovery that there were leaks in 104 of the 342 homes, totaling 11.3% of the entire water use of the municipality. A tabulation and study of the results showed 85.7% of the use lay between 50 and 400 gpd per customer; 12 customers using less than 50 gpd, and 10 customers more than 750. In only 8 of the 104 homes was the leakage under 10 gpd and in 31 it exceeded 100 gal.

The Hackensack Water Co. supplies about 500,000 consumers in 53 municipalities in northern New Jersey through 94,623 connections, all metered. In 1949 it started a program to study the range of use in apartment buildings with the use of "Meter Masters". Of 85 buildings studied, 35 had flush-valve water closets and 50 had flush tanks; almost all the new buildings had flush tank closets. Comparing the maximum rates of flow for entire buildings: for ¼ min. periods, this rate varied from 65 gpm for 10 apartments to 138 gpm for 130 apart-

ments for flush valves; and from 33 gpm for 10 apartments to 76 gpm for 70 apartments for flush tanks. Taken for 5-minute periods, the rates averaged 13 gpm for 10 apartments to 46 gpm for 130-apartment buildings for flush valves, and only 1 or 2 gpm less for flush tanks. In buildings having more than 20 apartments, service meters showed a continuous registration of 0.1 ± to 0.6 ± gpm during the 3-hour period from 2 to 5 A.M. This is considered to be due to cumulative fixture leakage in the building.

E. Arthur Bell and Edward Walasyk — "Recording Customer Use of Water;" *Journal American Water Works Ass'n*, October.

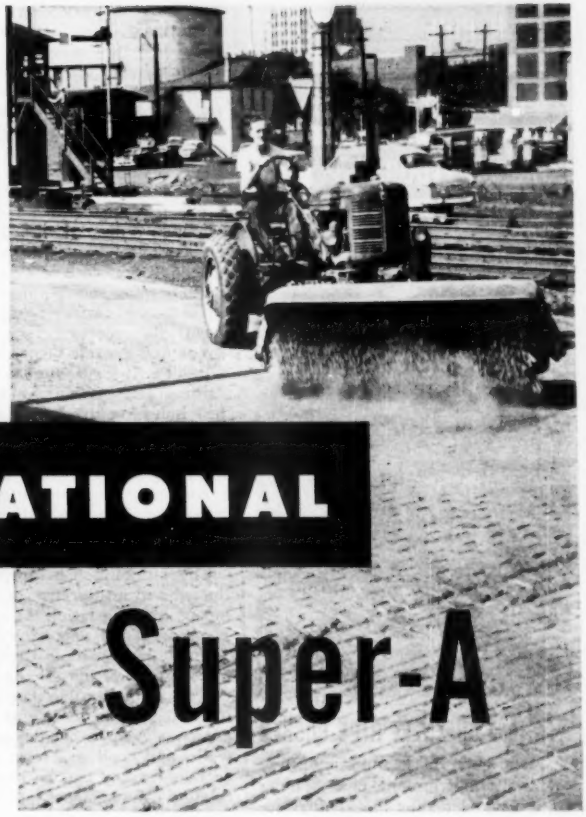
Prospecting for Ground Water

Methods available for prospecting for ground water include geologic, geophysical, test drilling and pumping tests. A consideration of the geology of an area should generally be the first step, since it is fundamental in all cases, and is necessary for interpretation of results from geophysical methods. In some areas the geologic information available in published reports may be adequate; in others it should be supplemented by test drilling. Some types of geologic formations cannot be expected to furnish a sufficient supply from a single well, while others can. A knowledge of the local geology permits prediction of the presence or absence of artesian conditions; also of the kinds of mineral matter probably dissolved in the water from a given stratum. *R. M. Leggette.*

Geophysical methods serve only to supplement geologic, hydrologic or test drilling investigations, or sometimes to furnish the same information more economically. Probably one of the greatest hazards to the proper application of geophysics is the pseudo-geophysicist who is interested in selling a particular method regardless of the physical contrasts present. A number of partly trained or untrained persons have attempted to locate ground water with radar, although the short waves used in radar penetrate earth materials to such slight depths—usually a fraction of an inch—that they have no conceivable utility in ground water prospecting.

Geophysical methods measure physical contrasts, and are of value only where such contrasts are present. The methods include radioactivity, gravity, both applicable un-

All-Weather Worker



the INTERNATIONAL Super-A

Kalamazoo, Michigan, keeps an International Super A wheel tractor busy the year 'round. The versatile tractor, equipped with a broom, sweeps streets and alleys and brushes gravel used for repairing pavements. In winter, the Super A clears snow from yards and sidewalks in the vicinity of the municipal garage.

Kalamazoo's superintendent of streets says, "Our Super A is in steady use for everything from cleaning pavement to brushing road pea gravel. It has worked for over a year without repair."

International wheel tractors are available in five sizes and seven models. Contact your International Industrial Power Distributor and let him help you select the right size International for your specific needs. He will show you how these extremely flexible tractors will help you cut municipal costs to the bone and keep your operations at peak efficiency. You'll find these dependable, all-weather workers are the ideal solution to a host of municipal problems.

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der only a very few specialized conditions), seismic, magnetic, electrical potential, electrical resistivity, thermal, and electromagnetic. The seismograph has been used directly for the location of water-bearing materials and for geologic mapping of subsurface conditions. It seems likely that there will be much use of seismic methods in the future. Little use can be made of magnetic methods in water prospecting. The chief use of electrical potential is in connection with test holes, to locate porous and permeable strata. Most uses of resistivity method have been for locating water-bearing sands and gravels in glacial drift or alluvium. It serves best to guide test drilling and reduce the number of test holes required. The equipment used is highly portable. Geothermal methods are of little use in prospecting for water, but when it has been produced its temperature may be important. The application of electromagnetic methods in this field is in its infancy. *Carl A. Bays.*

The pumping test, properly conducted and interpreted, provides the means for translating the inferences of geology and geophysics, relating them to the results of the test drilling and appraising all the information in a quantitative manner which furnishes the engineer with the basic data necessary for the design of wells and well systems. Thus, an economic study can be made of the relative importance of diameter, spacing and distribution of wells in any aquifer, as well as a prediction of interference effects and extent of liability to the wells of adjoining owners, and a determination of long-range performance. *John G. Ferris.*

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Relation Between Municipal and Industrial Water Treatment. By *J. N. Welch*, Assoc. Dir. Hall Labs. October, Pp. 966-974.

Tentative Standard Specifications for Ferrous Sulfate. October, Pp. 975-980.

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Chicago Water System Serves Growing Population with Decreased Pumpage. By *W. W. DeBerard*, City Engineer. November, Pp. 17-21.

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Gate Protects Water Pumps From Grit Damage at Intakes. Oct. 19, P. 41.

Mexico's First Water Softening Plant. By *Wm. E. Bell*, San. Engr. Nov. 2, P. 45.

How to Prevent Pipeline Freezing. Nov. 9, Pp. 38-41.

Public Works

Prestressed Concrete Pipe Saves Steel. November, P. 36.

A Model Filtration Plant for a Problem Town. By *J. L. Morrison*. November, Pp. 38-39.

Small Water Treatment Plant. November, P. 49.

Water & Sewage Works

Charges for Private Fire Protection Service. By *Richard H. Ellis*, Factory Mutual Eng. Div. November, Pp. 441-445.

Operation of Small Water Works. By *A. E. Clark*, Mgr. Nashville, Tenn. Suburban Util. Dist. November, Pp. 454-455.

Are We Ready for High-Rate Filtration of Water? By *John R. Baylis*, Engr. of Water Purif., Chicago. November, Pp. 456-458.

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Machines Aid Combined Billing for Water and Electricity. By *Robert E. Price*, Supt., Mun. Light & Water, Logansport, Ind. November, Pp. 1,000-1,001, 1055.

Universal Metering—Would It Solve Our Water Problems? By *Arthur Gilbert*, England, and *Harold W. Griswold*, Cons. Engr. November, Pp. 1002-1004, 1040.

City-Operated Golf Courses

A survey of municipal golf courses operated by 23 California cities, recently made by the Alameda Citizens' Advisory Committee and reported in *Public Management*, shows that an average of 15 full-time employees are required to maintain an 18-hole golf course and that they are directed by a professional golfer who generally is under the supervision of the park or recreation department. The payroll for the maintenance of an 18-hole golf course averages about $3,800 a month or $36,000 a year. Revenues derived from the municipal golf courses range from $171,000 a year in Pasadena to $11,000 in Antioch, California. Municipal officials believe that a golf professional should not be the manager but that the two jobs should be kept separate and that the manager of the course should be directly responsible to the head of either the park or recreation department.

PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Unusual Side Hill Construction

The West End Bypass, nearing completion in Pittsburgh, Pa., is a 4-lane-divided concrete roadway located on a mountainside shelf, 10 to 30 ft. above an existing railroad line. The original ground line had a slope of approximately 1½ to 1, and it was necessary to carry the excavation to the top of the hill, 190 ft. high in places, over much of the 5,000 ft. length, distributed in three cuts. The road contains two 24 ft. concrete roadways with a 4 ft. separation strip, in a roadway grade 72 ft. wide. In connection with the designing, core borings were taken along the center line at intervals of about 300 ft. and test holes were drilled along the cross-sections. The core borings were available for inspection by prospective bidders on the job.

A 16 ft. bench with drain ditch was established at various heights above the road; in some cases more than one bench was necessary to prevent slides. Intercepting trenches were placed at the tops of the cuts, discharging into 15" to 24" pipes, which in turn discharge into inlets and culverts which take surface run-off under the roadway.

"They Scalped a Mountainside to Build New Pittsburgh Expressway Link: *Roads and Streets*, October.

Relaying an Oil-Mix Surface

Near Harrisburg, Ill., a 450-ft. section of oil-mix road was reinforced recently by use of an Athey force-feed loader and a Caterpillar motor grader. The black top was scarified 6" deep for 20 ft. width. The grader bladed the scarified material into three windrows, which were picked up by the loader and passed through a portable breaker towed by the loader. The breaker crushed all material over 1" in diameter (the average oversize of about 35% of the material being 3½") and all of it was discharged back onto the road, where it received a shot of road oil, was again windrowed, and then was bladed to a smooth surface by the motor grader. The entire reconstruction was completed in just under 3½ hrs.

"Relaying Oil-Mix Surfaces Mechanically;" *PUBLIC WORKS*, November.

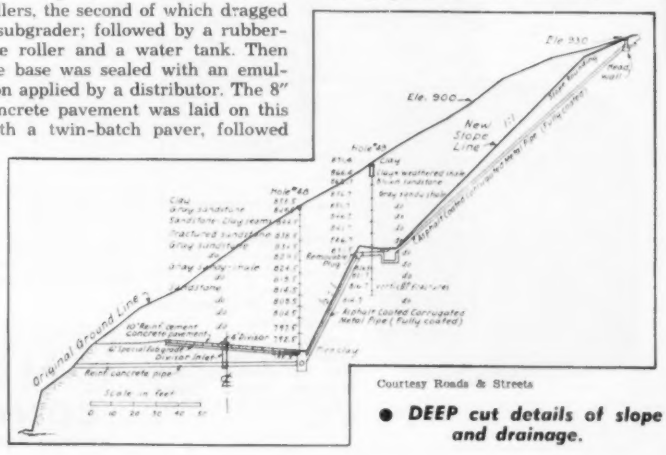
Concreting on Hollywood Freeway

In laying an 8-lane divided highway in Los Angeles, the contractor is using equipment to the utmost. A tractor draws a drag blade on a sub-grade, with an engine-driven conveyor to remove excess material: behind which are drawn a combination scarifier, ripper, blade scraper, window shaper, and a cement-injection device. (Plans called for from 3 to 5% of portland cement in the upper 8" of granular base, distributed uniformly with moisture by mixed-in-place treatment.) Cement is injected into the center of the windrow by a feeder device geared to the front wheels. Mounted on the machine is a 6500-lb. cement hopper, charged at intervals by a truck crane. A second group of machines, which mixed and relaid the material, consisted of a roadmixer, water tank and spreader drag, drawn by another tractor. At once the surface was compacted with two 3-wheel rollers, the second of which dragged a subgrader; followed by a rubber-tire roller and a water tank. Then the base was sealed with an emulsion applied by a distributor. The 8" concrete pavement was laid on this with a twin-batch paver, followed by a spreader, a finisher, a joint cutter and a float finisher. A burlap finisher was dragged behind, and the surface covered with membrane cure. The following day the forms were pulled with a truck crane.

"Hollywood Expressway Paving in High Gear;" *Contractors and Engineers Monthly*, November.

Concrete Test Road in Michigan

A progress report has been published by the Michigan State Highway Dept. stating certain conclusions from the study of a concrete test road constructed in 1940. The problems investigated included the spacing of expansion and contraction joints, and maximum amount of steel reinforcement necessary. One conclusion was that expansion joints are unnecessary except at such places as intersections, railroad crossings, where excessive compressive stresses introduced by expansion forces are undesirable. The commercial bitumen-rubber joint-sealing compound was found to be far superior to the straight asphalt or tar products in common use. Apparently there are many advantages in long-slab construction as compared to short slab, through better riding qualities, lower maintenance



Courtesy Roads & Streets

● ***DEEP cut details of slope and drainage.***

costs, and better construction methods. A comparison of mechanical and hand methods of tamping forms on granular subbases and subgrades showed the mechanical tamper to be so far superior to hand tamping that the department requires it on all concrete pavement construction. No conclusion was reached relative to the amount of reinforcing desirable, as all parts of the pavement are in excellent structural condition.

"Michigan Reports on Concrete Test Project;" *Better Roads*, October.

Freeways Increase Property Values

The California Div. of Highways has studied the effect on land values and on business of opening freeways around the business district in the cases of three cities. It found that the gross volume of business handled by retail merchants along a street from which through traffic had been removed to a freeway increased by a greater percentage than that in other parts of the city.

Properties adjacent to or abutting expressways and freeways, which have limited access or no direct access to the through lanes of traffic, increase in value at a rate in excess of that for comparable properties abutting conventional streets or highways which are in the same general vicinity and where there have been no changes in conditions of access between the through lanes of traffic and the property.

An expressway or a freeway development with its accompanying controlled access eliminates strip development by marginal enterprises, and the usual accompanying cut-price or "cut throat" type of competition, and stimulates the growth of substantial, permanent business establishments on a sound basis.

Frank C. Balfour—"How Freeways Increase Property Values;" *Engineering News-Record*, Oct. 12.

Making a Fill in Swamp

In relocating a part of U. S. 90 in Alabama it was necessary to cross about 2500 feet of swamp with muck reaching a maximum depth of 11 ft.; it was planned to consolidate the muck by constructing a drainage ditch down to hardpan along each right-of-way line. After finishing one ditch it was found that this was not satisfactory. Instead, the muck was liquefied by blasting, using a pound of 50% dynamite for each cu. yd. of muck. After blasting, a predominantly sandy material was back-dumped into the liquefied muck, forcing it ahead and to the sides.

"Five-Mile Dual Road Is Graded in South;" *Contractors and Engineers Monthly*, November.

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Specially Designed Auxiliary Water Supply Fire Truck

ALBERT M. ZUILL
Ass't. Supervisor of Roads,
Natrona County, Wyoming

WE are in a semi-arid country, which has an annual rainfall of about 15 inches. Our county fire truck, housed in No. 1 Station of the Casper Fire Department, responds to calls in the county outside of the corporate limits of Casper. This truck has a 500-gal. water tank, as well as chemical extinguishers and miscellaneous small fire fighting equipment. It has been found that the truck water supply is sufficient for the initial fire fighting only, especially when fighting prairie, brush or timber fires in draws or canyons, on Casper Mountain, or in the foothills of the Big Horn Mountains. Consequently an auxiliary water supply must be hauled to the fire.

A Dodge power wagon was purchased by the County to meet this need for an auxiliary water supply. It has 4-wheel drive, enabling it to operate in rough and mountainous country; and it is equipped with overload springs to carry its initial tank load of 500 gallons of water. It also carries a Pacific one-cylinder air-cooled gsaoline engine driven pump and a 16-ft. length of suction hose so that it can refill its water tank from any spring, stream or reservoir, and keep the fire truck in operation at the site of the fire.

The Dodge power wagon is equipped with a 500-gallon water tank, and with steel compartments welded on the sides of the body to carry 1,200 ft. of fire hose, electric lanterns, picks, shovels, mattocks, bars, tow chain and first-aid equipment. It is stored at the County Highway Department garage, with the water tank filled and the rear end jacked up to relieve the springs. In case the County fire truck is called out to a place where it is likely to need additional facilities, the auxiliary truck is manned by the Department mechanic and his assistant, and is taken out.

In the winter, when fire needs are unusual, this truck, with the water tank empty, is kept with chains on all four wheels. It is used for opening roads outside of the city limits

during periods of heavy snowfall, such as to dairies, for school bus routes, and for food, fuel or supplies to isolated ranches not served by regular snow plow routes. In fact, operation of this truck is auxiliary to the major county snow plow equipment, which consists of a 4-wheel drive truck with a V plow and side-arm, a motor grader with V plow and side arm, and a Caterpillar D7 with bulldozer equipment, which is used for deep, hard-packed drifts.

The County Commissioners are contemplating installing short-wave radio equipment to provide communication between snow-fighting equipment and the base, as well as between their fire-fighting equipment and the base.

Using Sanitary Fill Methods in a Wet Area

In the Texas City, Tex., area, the water table is near the ground surface, so that special methods for sanitary fill had to be developed. The sanitary fill is located in a waste marsh area north of the city where the ground elevation is only 6 ft. above mean low tide. During prolonged wet weather quicksand conditions occur at a depth of 3 ft. This makes it necessary to use a dragline to excavate for the fill during about 5 months every year.

Because of the lowness of the area, the excavation fills with water. When this occurs, the trash is burned before it is pushed into the excavation and compacted with the Drott-International tractor and bull-clam. Burning leaves a residue that will sink through the water to the bottom of the excavation. After filling, the tractor-bull clam covers the fill with earth and compacts it.

Sewage and Garbage Disposal at Marion, Ind.

Marion, Ind., population about 32,000, treats its sewage by the activated sludge method, with digestion of all sludge. The gas is used for operating gas engines. All garbage collected by the city is ground at the treatment plant and digested with the sewage. The digested sludge is removed by tank truck and hauled to farm land for use as fertilizer. During 1949, 2,359 loads were sold to 46 customers within a 6-mile radius of the plant, the cash revenue amounting to $2,454.55. During wet weather, when the trucks cannot unload on the farms, the excess is pumped to a lagoon at the treatment plant.

During the year, 1,779 mg of sewage was pumped and 1751.6 tons of green, garbage were processed. The gas produced totaled 21,238,200 cu. ft., of which 19,579,000 were utilized. The average cost for collection of garbage was $8 per green ton as weighed on the trucks. No charge is made for disposing of the garbage, the cost of this being offset by the value of the gas recovered from it. The total gas recovered averaged 2.18 cu. ft. per capita per day, with a maximum of 2.84 cu. ft. in August and a minimum of 1.56 cu. ft. in January. The sewer gas furnished 68% of the total power at the plant, and its value (at 50 c. per 1,000 cu. ft.) was $9,736.75.

The plant reduced the suspended solids from 169 ppm in the raw sewage to 10 in the final effluent; and the BOD from 136 ppm to 7 ppm in the final effluent.

Of the 4,837,500 gal. of digested sludge removed, 22.2% was pumped to a lagoon of 600,000 gal. capacity. The remainder was hauled to farms in a 1500-gal. tank truck at an average net cost of $2.76 per dry ton.

The return from sales averaged $3.75 per dry ton. The sludge averaged 3.65% dry solids. The dry solids entering the digestion tank in the raw sewage totaled 3,264,000 lbs., and those in the ground garbage 548,780 lbs. In August the garbage furnished 28% of the dry solids.

The above figures are from the annual report of David Backmeyer, Supt. of the Sanitation and Water Departments.

Repairing a Bridge by Driving Piling Under It

C. C. Washington

Galveston Co. Engr., Texas

THE original viaduct over Offats Bayou on Butterowe Boulevard, just outside of Galveston, consisted of two identical side-by-side bridges, built at different times. These had four bents of 50-ft. piles, 14-ft. on centers, with 10″ by 12″ caps. Stringers were 3″ by 12″, 28-ins. on centers; and the flooring was also 3″ by 12″. The road surface was composed of 5-ins. of shell and a ¾-inch penetration surfacing. The floor grade was about 6 ft. above ordinary tide and the channel depth was also about 6 ft. The two bridges were built some years apart, the easterly one having been built first.

The piling on the older bridge was seriously attacked by teredo and limnoria at the low water level. The necessity for repair was reported to the commissioners Court two years ago, but I was unable to get authority to make the repair. When a very low tide occurred recently, I took the County Judge to the bridge. After one look, he said: "Do something, but quick." Free hand for me.

The cap and deck of the bridge were good. I arranged with Nunez Construction Co. to drive 16 50-ft. piles and spring them under the caps, for which work a fixed price was agreed to. The International Creosoting Co. agreed to deliver the piling at Galveston within five days. The County's job was to bring the piling to the bridge and uncover enough of the bridge deck to permit placing the new piling.

The Nunez Constr. Co. brought in a crane mounted on a steel barge on Monday morning. County forces removed three decking planks, surfacing, etc., from the sides of each bent, and hauled in the piles. The contractor started jetting and driving the piles 12″ to 14″ off center from the old piling. Jetting usually took the piles down to where not more than 8 ft. of driving into clay was necessary. The rig operator was especially good in handling the hammer without leads on the top of the piles.

Shortly after noon on Wednesday the piles were all driven. Springing the piles under the caps was easily accomplished by pulling from the rig. The old piling was left in place. County forces replaced the flooring and surfaced the cuts with transit-mixed high early strength concrete. The job was opened to traffic Thursday morning. Total cost of repairs was approximately $2,700. Comparatively it was a small job, but it was of special interest to me because cooperation by the material supplier, the contractor and the county, plus the exercise of a little ingenuity in planning the work, resulted in a quick and economical job.

PUBLIC WORKS DIGESTS

THE SEWERAGE AND REFUSE DIGEST

Sanitary Landfills

The usual production of garbage and refuse is 2 to 3 lb. per person per day; of garbage alone, 0.3 to 0.7 lb. One ton of garbage and refuse occupies 1 to 2 cu. yd. when compacted, compaction reducing the waste to 20% to 35% of its original volume. On these bases, one cu. yd. of compacted material may be expected per person per year. In deciding on location of a landfill, consider the time lost and expenses of vehicle operation over long hauls, and the character of the roads leading to it. Consider subsurface seepage, possible channels or crevices in underlying limestone, etc. Chemical pollution from a fill may carry long distances underground as compared to organic and pollutional travel. Seepage from sanitary landfills has shown strengths ranging from 170 to 5,900 ppm BOD; coliform organisms to 9,500 per ml; total bacterial counts to 33,000; nitrogen and ammonia to 62 ppm; and iron to 52 ppm. Sewage and water mains should not pass through fill material. Surface water should not flow onto a fill, and the slope of the fill surface should be at least 1% to assure drainage. The equipment used may be any of the following: Track-type tractor with bullclam or front-end loader; bulldozer and dragline; carryall scraper and bulldozer; bulldozer and trucks to haul in dirt; and other combinations, depending on local conditions. The refuse should be compacted in layers not over 12 ins. deep; the compacted depth of a single lift should not exceed 8 ft. A snow fence or a netting of chicken wire should be placed, according to the prevailing winds, to catch blowing papers.

"Locating, Designing and Operating Sanitary Landfills;" *PUBLIC WORKS*, November.

Digester Cover With Center Support

The new Portland, Ore., treatment plant, now under construction, includes four sludge digesters 90 ft. in diameter and 23'3" side water depth. Three of these have floating covers of new design, in that there are four concrete piers in the center of each digester, on which the center of the floating cover rests when in its down position, thus reducing the span of the cover trusses by 50% and permitting lighter construction. Each unit includes 18 trusses radiating from a central core which includes a 7-ft. dia. gas dome. The bottom of the cover is covered with steel plate; the top with a wooden roof and tar and gravel roofing material.

"Digester Cover Has Center Support;" *Engineering News-Record*, Nov. 9.

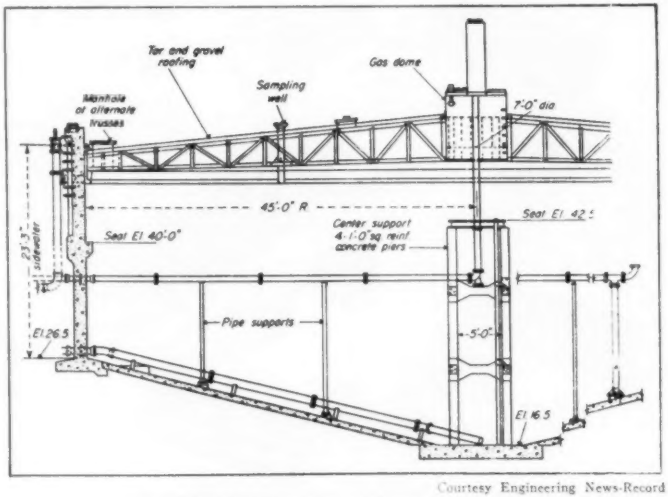
Steel in Sewage Plants

Data from 15 sewage treatment plants, varying in size from 1.4 to 360 mgd, showed that there were used in their construction an average of 507 tons of reinforcing and miscellaneous steel and cast iron pipe and fittings per million dollars of cost, with a minimum of 309 tons and a maximum of 980. Reinforcing steel alone averaged 332 tons per million dollars; or 46.4 tons per mg of capacity; or 126 lb. per cu. yd. of concrete. Of cast iron pipe and fittings, the average for 11 plants for which capacity data are available was 15.5 tons per million gallons; for the six smallest was 39 tons. The amount of pipe used depends largely on size of plant and method of treatment; plants employing two-stage high-rate filters use a great deal of pipe.

"Steel Required for Sewage Treatment Plants;" *PUBLIC WORKS*, November.

Danger of Fertilizing with Sludge

The authors reviewed available literature, including 121 items, dealing with the viability of the more common intestinal pathogenic organisms of a bacterial or virus nature which could cause disease by ingestion of raw fruits and vegetables on which sewage sludge had been used as fertilizer. These diseases include typhoid, paratyphoid, bacillary dysentery, cholera, tuberculosis, streptococcal infections, and poliomyelities. The conclusions reached were that raw fruits and



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● ***DIGESTER** cover with center support.*

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vegetables growing in infected soil can be contaminated with pathogenic bacteria, and that it may be difficult to disinfect them, especially injured or broken parts. As to survival of bacteria, *Esch. coli. E. typhosa* and *M. tuberculosis* appear to be most resistant. Lower temperature increases viability, as does moisture in the soil. Neutral soils favor longevity, and the type and amount of organic matter present may serve as a food and energy source to sustain or allow bacteria to increase. The presence of other micro-organisms tends to shorten the survival.

Willem Rudolfs, Lloyd L. Falk and R. A. Ragotzkie—"Literature Review on the Occurrence and Survival of Enteric, Pathogenic and Relative Organisms in Soil, Water, Sewage and Sludges, and on Vegetation;" *Sewage and Industrial Wastes*, October.

Experience with Saran-Wrapped Tubes

Columbus, O., in 1938 put into service eight aerators, each containing 1328 diffusion plates grouted in containers. After about five years, leaks developed through the grout. Also, although the air was filtered, dirt accumulated on the bottom of the plates and the blower pressure increased from 7.3 lb. to 8.5 lb., and it was necessary to put one tank out of service periodically for plate maintenance, which would require building an additional unit at a cost of $400,000. Plate maintenance costs about $3,000 a year. To avoid this, the tanks have all been modified to use swing diffusers at a cost of $312,000. The maintenance cost would be little because the operator can clean the swing units, one at a time, during spare (?) moments. After investigating the saran-wrapped type of tube it was decided to adopt them instead of the ceramic type. The change had been completed by October, 1948, and the air pressure fell, distribution of the diffused air was more uniform, and the units operated with good aerobic conditions at 20% over the designed capacity.

A bacterial jelly coating forms on the tubes, and when this causes an increase of air pressure of 0.75 lb., the units are raised and cleaned by high-pressure water jets from the inside of a ring which is passed over each tube separately without detaching it from the header pipe, the air pressure being left on the tube meantime. This does not clean the tubes to new tube rating and it probably will be necessary to soak them in an acid solution every two or three years. Experience indicates that the jet cleaning costs about 2¢ a tube, and soaking in acid followed by jetting about 10¢. There are about 800 tubes per tank, and the average cost per year of jetting twice a year and acid cleaning every two years would be 9¢ per tube or $72 per year per tank.

James H. Blodgett—"Air Diffusion with Saran-Wrapped Tubes;" *Sewage and Industrial Wastes*, October.

Economics of Waste Treatment

Waste treatment processes and plants are a necessity in many classes of manufacturing operations. To reduce the net cost of such treatment, not only the first cost is to be considered, but also the operating costs, which may include cost of chemicals, maintenance of equipment, and labor. In many cases the cost can be reduced or even exceeded by the recovery of valuable products and the reuse of water after treatment. Where neutralization of acid is the only treatment necessary, and the flow rate does not exceed 150 gpm, the simple equip-

ment required may not cost more than $1400. An installation for treating 250 gpm of waste water of varying acid content, feeding lime through a valve controlled by a pH meter, costs $2,500 to $5,000; and the lime costs 0.80¢ per 1,000 gal. per gr. per gal. No practical methods for recovering chromium, copper and zinc from brass mill wastes have been developed.

In the case of paper mill white water, screens and sedimentation tanks can recover much of the fibrous solids, worth $35 a ton; 80% of the water can be re-used. For treating 2 mgd of white water, including use of a "Solids Contact" reclaimer for reducing the concentration of stock to less than 0.25 lb. per 1,000 gal., a plant cost $80,000; soda ash, $3,000 a year; alum, $1,000 a year, and labor $8,000; giving a total annual cost of $20,000. Offsetting this, recovered stock was worth $11,700 a year; recovered water, $9,600; recovered heat, $18,000; a total of $39,300.

V. J. Calise—"Economics of Waste Treatment;" *Water & Sewage Works*, November.

Believe It or Not

In dismantling the 20″ gate valve on the suction side of a sewage pump in the Marion, Ind. plant (it would not operate until it was dismantled), they found in the valve housing such items as nails, paper clips, wood screws, metal screws, razor blades, bottle openers, keys, bus fare tokens, metal washers, curtain clips, rifle bullets, and even two U. S. copper coins, as well as general sewage mineral grit.

David P. Backmeyer—"The Daily Log;" *Sewage and Industrial Wastes*, October.

Disposal of Brewery Waste

The Lucky Lager Brewing Co. worked in close cooperation with the health authorities of Los Angeles County and the State of California in developing a plan for disposing of its wastes, accepting full responsibility for such disposal. The plant was based on the assumption of 13 bbl. of waste water containing 1.5 lb. of BOD and 0.8 lb. of suspended solids for each barrel of beer produced. The plant includes a rotary fine screen; 2 settling tanks, the primary having a skimmer; 2 bio-filter beds and provision for recirculating with a ratio of 2.5 for both primary and secondary filters; a heated sludge digestion tank; 3 sludge drying beds; and 4 final effluent percolation beds with a total area of 32,000 sq. ft., through which the effluent settles to the country's underground water basin.

Ruben Schneider—"Waste Disposal at a Modern Brewery; *Sewage and Industrial Wastes*, October.

Treating Wastes From Phenolic Plastics

The Durez Plastics-Chemicals, Inc. manufactures phenolic molding compounds, industrial resins and protective coating resins. The principal wastes are polychlorinated benzenes, hydrochloric acid, caustic waste solution, and tars. The waste acid is neutralized with lime and discharged to the sewer; it contains about 0.2% phenol, and continuous filtration and evaporation to remove this is being investigated. The caustic washes contain traces of phenol, acid and benzene and are neutralized in a vigorously agitated mixer, but the emulsion formed carried up to 800 lb. of phenol to the sewer each day, which has been reduced to 10 lb. per day by means of a glass fiber bed. The tars are buried in dumps.

In manufacturing resins, 60,000 lb. per day of a distillate containing 2 to 8% phenol is produced; 90% of which is removed by a process de-

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veloped in Germany. A pump feeds distillate at 10 gpm through a cone filter and preheater to the top of an extraction column 35 ft. high, 25 ft. of it packed with Raschig rings. Another pump feeds benzene to the bottom of this column. The distillate, freed of suspended solids and resinous matter by the cone filter, and preheated, passes through the extraction column and leaves at the bottom essentially free of phenol, the removal efficiency varying from 90 to 99%. The water is saturated with benzene, which is recovered. The benzene is distilled from the benzene-phenol mixture that overflows the extraction column, and the phenol is removed as bottoms product.

Norbert H. Kirchgessner—"Treatment of Phenolic Plastic Wastes;" *Sewage and Industrial Wastes*, October.

Sludge Utilization At Greenwich, Conn.

Greenwich operates four plants, two of which have heated sludge digesters and two have unheated ones. At each plant the digested sludge is air dried, passed through shredders and stored on concrete platforms. About 90% of it is used by the Park Department, the remainder by private individuals in small quantities. It is free to all residents of the town. The Park Department stock piles the sludge and covers it with commercial superphosphate. After it has aged, part of it is composted with leaves, grass cuttings, etc. and used for seedlings, flowers and shrubs. Another part is reground and spread over the grassed areas by means of a sand spreader. A third part is mixed with earth and used for tree planting and as a sub-base for newly seeded areas. The park department uses about 300 tons of sludge a year, with an estimated fertilizer value of $7,000; in return for which it reconditions the sewer department's hand and power mowers.

R. J. Kent—"Sludge Utilization at Greenwich, Conn.;" *Sewage and Industrial Wastes*, October.

Oxidation of Formaldehyde

Formaldehyde is found in wastes discharged by many industries. Because of its toxic effects on microorganisms, study was made of its effect on biochemical oxidation and to learn whether a flora could be developed capable of high-rate oxidation of high concentrations of formaldehyde. It was concluded that a concentration of 135 to 175 ppm is thus toxic; but by a process of adaptation and selection a flora was developed that tolerated a concentration of 1750 ppm, and increased the percentage of formaldehyde oxidized during the first 24 hr. from zero to 95%. Before ammonia nitrogen is found in the effluent, nitrogen must be added to satisfy the BOD to N ratio of 40:1; and additional buffer to prevent excessive lowering of pH and reduction of oxidation rates. The sludge, which settles rapidly, appears to consist of dense aggregates of *Bacterium methylicum* and has a characteristic pink color.

Isaiah Gillman and H. Heukelekian—"Biological Oxidation of Formaldehyde;" *Sewage and Industrial Wastes*, October.

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Sewage and Industrial Wastes Engineering

Low Spots Are Trouble Spots in Plant Electrification. By *Victor Greif*, Bureau of Sew. Disp. Design, New York City. November, Pp. 586-587, 610.
Tips on Sewage Treatment Plant Design and Operation. By *Le Roy W. Van Kleeck*, Prin. San. Engr., Conn. Dept. of Health. November, Pp. 590-593.
Handling Problems of Operation and Maintenance. Forum discussion by *Geo. H. Craemer*, Hartford, Conn.; *David Backmeyer*, Marion, Ind.; *H. T. Rudgal, Kenosha*, Wis.; *Paul C. Hedenstad*, Worcester, Mass.; *John R. Szymanski*, New Britain, Conn.; *Geo. Martin*, Green Bay, Wis.; *Wm. M. Wallace*, Detroit, Mich., and *P. D. Craun*, Rochester, Minn. November, Pp. 594-599.

Water & Sewage Works

Sewer Maintenance and Cleaning Practices. By *John W. Hood*, Supt. Sew. Treat., Ridgewood, N. J. November, Pp. 464-466.
Addition of Garbage to Sewage. By *T. E. Haseltine*, Cons. Engr. November, Pp. 467-472.
Milk Waste Treatment on an Experimental Trickling Filter. By *Earnest F. Gloyna*, Asst. Prof., Univ. of Texas. November, Pp. 473-478.
Economics of Waste Treatment. By *V. J. Calise*, Graver Water Conditioning Co. November, Pp. 479-483.

Six-Year Sewerage Project Completed in North Santiago, Chile

With President Gabriel González Videla in attendance, the sewerage system constructed by the *Departmento Cooperativo Interamericano de Obras de Salubridad*, joint agency of the Chilean and United States governments, was inaugurated May 25th.

The sewerage system, serving a population of 128,000 in the northern section of Santiago, consists of approximately 144 miles of sewers with 27 miles of house connections. The total cost of the project was $1,954,019.42, more than half of which was contributed by the Chilean government.

Construction was started in July 1944, with the work divided into four separate projects. The system existing prior to 1944 served only a portion of a thickly populated area and discharged the sewage into irrigation ditches, rendering approximately 98,840 acres unfit for cultivation. The new system frees about 49,420 acres for industrial purposes, as well as for gardens and vegetable growing.

The work on the North Santiago sewerage system was greatly aided by the use of a mechanical, packerhead type, concrete pipe making machine. This machine formed a part of the pipe plant which furnished materials necessary for the project. The cost of the Model "T" McCracken machine, installed, was approximately $50,000. Because of the great amount of pipe required on this project, it was possible to effect a 30 per cent reduction in the cost of the mechanically-made pipe over that of the hand-processed. This machine will be available for additional sewer work in Santiago or other cities in Chile, such as Valparáiso, Viña del Mar and Concepción.

Jamaica Water

(*Continued from page* 37)

By means of the pilot plant investigation and a complete analysis of the capital and operating costs of the four different processes proposed, a plant design was developed to produce the desired results and provide a saving in capital investment and operating costs. Results show that iron can be removed by the use of air alone but that lime is

beneficial to remove the manganese and provide the pH required to deliver a non-corrosive water into the distribution system. Prior to the construction of the treatment plant, chlorine was applied at all times to the discharge from the wells for the control of iron bacteria; but it will be used only periodically in the future to prevent a build-up in the transmission lines.

Industrial Wastes

(*Continued from page* 38)

ceiving stream should not be overlooked. This investigation should include not only the toxicity of the waste to the fish life itself, but should also include studies of its effect on the fish food organisms that are present in the stream.

Laboratory Needs

If the plant is large and possesses a well equipped and well staffed laboratory, some of the preliminary analyses might be made in this laboratory. In general, however, plant laboratories are set up for routine procedures that are designed for the operational control of the plant processes. The making of special analyses involving different equipment, different standards and different techniques disrupts routine and is generally unsatisfactory. Some special provision should be made, therefore, for those investigations that fall outside the regular work of the plant laboratory by either setting up a new division in the laboratory organization, or by employing the services of an outside organization. The employment of a commercial laboratory on a fee or contract basis may be the most economical approach for the preliminary investigational studies.

The preliminary study should disclose those process units and wastes which require a more critical study. At this point management should set a definite policy regarding pollution abatement. Representatives from the technical, operating, and engineering departments should discuss the waste recovery problems and formulate a program of study. This program should be directed toward making the recoveries which would require the least changes in the operating process or the smallest investment in equipment. The study program should consider improvements in operation and elimination of part of the objectionable material in the waste. Available methods of waste treatment and disposal that are applicable to the particular waste involved should be studied.

If the preliminary investigation indicates the possible presence of by-products that would be of value, possible methods of recovery should be considered.

As soon as the study program has been decided upon, the technical personnel of the waste organization should be increased. The type of analytical procedure that will be employed should be fairly definitely known and a laboratory unit having the necessary equipment and personnel should be organized and provision should be made for constructing and operating pilot plant units. As the work progresses, periodic reports should be made to keep the plant personnel informed and impress upon them the necessity for waste reduction. In addition, these reports will serve as a permanent record of the company's study of its waste problem and of the progress that is being made in its abatement.

The waste problem can best be solved in this manner. After this phase of the pollution study has been substantially completed, remedial measures should be decided upon and the necessary steps taken to place the abatement program into operation. To obtain maximum benefits from such a program, there must be continual technical and operational interest and careful supervision of the program.

Much can be gained by cooperating with the representatives of pollution control agencies and with representatives of waste organizations of other industries.

A free exchange of technical information on problems of a similar nature can be mutually helpful and it will be found that the men responsible for the enforcement of pollution laws wish to cooperate with industry. By keeping the enforcement authority informed of the steps that are being taken and the progress that is being made, these representatives will be in a better position to respond to public inquiries concerning the pollution of streams and protect the industry from unwarranted attacks.

The State Health Department, as the pollution authority in this state, stands ready to assist industry in its waste disposal problems. Its trained engineers in the Bureau of Sanitary Engineering and its technical staff in the Bureau of Laboratories will be glad to cooperate with any industry desiring to establish a waste survey program by giving technical assistance in outlining the study program and in determining the type of equipment and analytical procedure that will be required.

PUBLIC WORKS EQUIPMENT News

Lighting Standards Undamaged by Hurricane

Miami's worst hurricane since 1926 did not damage the new Kerrigan street lighting standards. In the midst of uprooted trees; broken, bent and smashed old-style lighting poles; and much other damage,

Kerrigan light standards unhurt by hurricane.

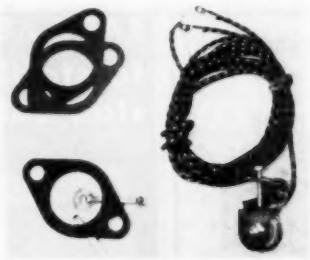
these new Weldforged standards withstood the 125-mile an hour winds. The new lighting system was installed shortly before the hurricane. Standards for the system were manufactured by Kerrigan Iron Works, Nashville, Tenn. For information, write the manufacturer or use the coupon.

Use coupon on page 93; circle No. 12-1

Self-Cleaning Filter for Many Uses

This is an industrial type of filter which is useful for any job where filtering involves large amounts of solids and where it is difficult or inconvenient to open the filter for cleaning. Cleaning is by flushing and the use of mechanically operated nylon brushes. In many cases, cleaning is accomplished in 2 to 5 minutes, and little backwash water is required. Full data on this filter from Sparkler Mfg. Co., Mundelein, Ill., or by using the coupon.

Use coupon on page 93; circle No. 12-2



Warms carburetors.

Carburetor Heater for Cold Weather Starts

When the temperature gets down below zero, cars and trucks sometimes don't start so well. Here is a device that makes it easy to start trucks, tractors and passenger cars even at 20 below zero. The preheater attaches to the battery line; when it is turned on, the hot element produces instant vaporization of the gas and immediate starting. Kemode Mfg. Co., Inc., 161 West 18th St., New York, will send full information or use the coupon.

Use coupon on page 93; circle No. 12-3

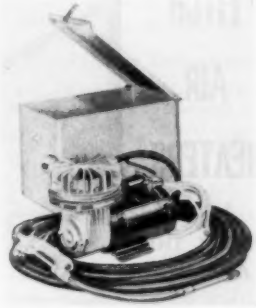
Deodorizing Garbage Handling

In the Washington, D. C., Refuse Transfer Station, near the Capitol, 300,000 cubic yards are handled annually. All operations take place indoors. The air from the unloading room is sucked up by fans and passed through banks of spun glass filters for dust removal. If the air is odorous, it is passed through banks of porous canisters containing activated carbon. The dust and odor control equipment represented only 4% of the total cost of the plant. Fuller information on design factors for such installations can be obtained from W. B. Connor Engrg. Corp., 114 East 32nd St., New York 16, N. Y., or by using the coupon.

Use coupon on page 93; circle No. 12-4

How to Drain Hydrants in 60 Seconds

It is no longer necessary to pump your hydrants by hand to prevent them from freezing. The new Adams Jet Drain will completely drain any standard fire hydrant in 60 seconds. You simply attach Jet Drain to your



1-minute hydrant drain.

fire hydrant and plug in an air line from a small portable battery driven air compressor. The compressor is operated from your present service truck storage battery and is easily installed in 30 minutes. Completely automatic, the compressor is guaranteed to deliver 100 lbs. of air pressure. Has many year-around uses such as spray painting, tire inflating, and will operate power grease gun. For full information, write Jet Drain Engineering Co., 215 N. Fayette St., Saginaw, Mich., or use the coupon.

Use coupon on page 93; circle No. 12-5

Sidewalk Salt and Sand Spreader

A new spreader, designed to skid-proof sidewalks, areas around public buildings, and entrances and exits at railroad and bus stations is available. It hitches to a small tractor, and will spread while moving forward or backward, placing a thin or a thick layer. It holds 600

pounds of sand; is 4 ft. overall width; and has penumatic tires. Full data from Baughman Mfg. Co., Jerseyville, Ill., or use the coupon.

Use coupon on page 93; circle No. 12-6

Small Water Ballast Power Roller

There are three models of this small roller, with filled weights of 600 to 86 0pounds. These are the tandem, the standard and the caster. Power is by a Briggs & Stratton 1½-hp engine. Main roll is 24 x 24. Recommended uses are for black top surfaces, patching, driveways, sidewalks and ditch compaction; also for many park and playground duties. Data sheet available from Gabb Mfg. Co., 16 Orchard St., East Hartford 8, Conn., or use the coupon.

Use coupon on page 93; circle No. 12-7

3 CC to 800 CC at 1,000 PSI

This pump has a plunger ⅛ inch in diameter and its capacity can be varied with exactness from 3 cc to 800 cc per hour; operating pressures are up to 1,000 psi. It is intended for handling clear liquids, and clean-out plugs are provided to permit use of pipe cleaners for removing deposited material. For applications and more detail, write Milton Roy Co., Philadelphia 18, Pa., or use the coupon.

Use coupon on page 93; circle No. 12-8

Lightweight Gasoline Engine

A vertical twin cylinder gasoline engine in lightweight aluminum produces 2 hp and is designed for any application where a vertical shaft drive is required. Weight and other details on this new engine can be obtained from Power Products Corp., Grafton, Wisc., or by using the coupon.

Use coupon on page 93; circle No. 12-9

Now's the time to mail this month's Readers' Service card.

"Mighty Mouse" Shreds Heavy Grass and Brush

The Mott hammer knife mower, with this small tractor, will cut, shred and pulverize weeds, heavy

That Mighty Mouse again.

grass and brush, making a fine mulch. The mower is separately powered and has a 4-ft. width. It is removable, permitting the tractor to be used for bulldozing, grading and general work. Write Mead Specialties Co., 4114 No. Knox Ave., Chicago 41, Ill., or use the coupon.

Use coupon on page 93; circle No. 12-10

New Digger for Small Jobs

Designed to fill the gap between expensive hand labor and the heavier excavating equipment, this new power digger unit works behind a tractor and is operated by the

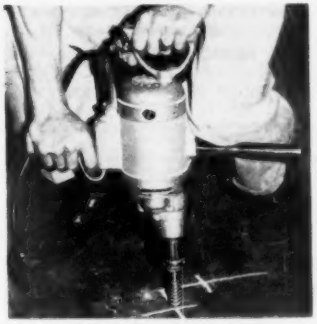
Sherman power digger.

tractor power take-off. It will dig 8 feet below ground level and the bucket can be raised high enough to load into any standard dump truck. This unit is designed for digging trenches, basements, footings, culvert and drain trenches and for loading. Cuts 18 ins. wide; bucket capacity 3.5 cu. ft. It can be installed or removed from the tractor in 15 to 20 minutes. Full information from Sherman Products, Inc., Royal Oak, Mich., or use the coupon.

Use coupon on page 93; circle No. 12-11

For Drilling Holes in Concrete

It is often necessary to drill holes in concrete for shields and anchors. "Stubbies" are now available. These are extra short rotary drill bits, with an overall length of 4 ins., available in sizes from ¼-inch to ⅞-inch. They can be used with electric drills, air motors or elbow grease. More information from Con-



Concrete Termite drill.

crete Termite Drill Co., 5145 Empire State Bldg., New York City, N. Y., or by using the coupon.

Use coupon on page 93; circle No. 12-12

For Measuring Radioactivity

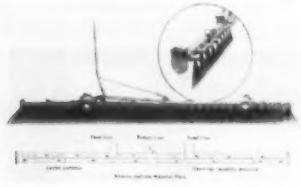
Here is something for the civil defense folks—a radioactivity measuring instrument, which expresses radioactivity in milliroentgens. This

meter is available with 4, 5 or 6 scales. The 4-scale model covers 0 to 0.5 mr; 0 to 5 mr; 0 to 50 mr; and 0 to 500 mr. For further information write Westinghouse Electric Corp., Box 2099 Pittsburgh 30, Pa., or use the coupon.

Use coupon on page 93; circle No. 12-13

"Hot" Spray Bar for All Distributors

This new non-clogging, no-drip asphalt spray bar is a full-circulating, 3-section hot bar. It provides



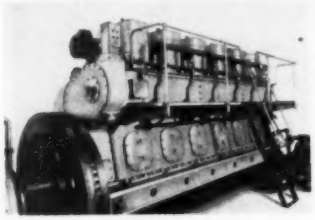
Hot bar for distributors.

end-to-end circulation in the bar, insuring uniform distribution from all nozzles. It is built in all lengths up to 24 ft. long. Full data from Wm. Bros Boiler and Mfg. Co., Minneapolis, Minn., or by using the coupon.

Use coupon on page 93; circle No. 12-14

New Baldwin Diesels with Increased Power Range

A new series of diesel engines, with capacities ranging from 700 to 2080 hp is being manufactured by



New Baldwin diesel.

Baldwin. These are 4-cycle, 6 or 8-cylinder, with speeds of 257 to 375 rpm. They are designed for most efficient service on municipal electric power plant work, pumping service and other stationary power purposes. Performance curves will be sent on request to Baldwin Locomotive Works, Philadelphia 42, Pa., or by using the coupon.

Use coupon on page 93; circle No. 12-15

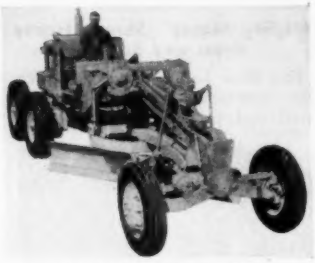
How to Saw Concrete or Asphalt Easily

Time and money can be saved on that patching job by using a saw to cut out the failed area. This applies

Easy to saw concrete.

even on small jobs, and portable saws are available for these jobs. Straight smooth edges facilitate good repair work. On trenching work, saws save time and reduce pavement damage. Cutting speed is 12 ft. a minute in asphalt and 5 ft. per minute on concrete, based on 1-inch depth; but these saws will cut to 6½ ins. deep. Three models are available. For data on them, write to Clipper Mfg. Co., 2800 Warwick St., Kansas City 8, Mo., or use the coupon.

Use coupon on page 93; circle No. 12-16



Multi-duty motor grader.

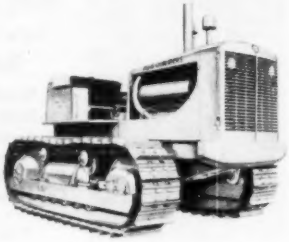
New Adams Motor Grader

A new model 70-hp diesel motor grader has been announced by Adams. This has an International engine; weighs about 19,000 pounds, with over 12,800 pounds on the rear wheels; has full-floating rear axle, 8 speeds forward, fast mechanical controls, and 12-ft. blade; it can be equipped with snow-plow, snow wing and bulldozer. Ask for information on the Model 312 grader from J. D. Adams Mfg. Co., Indianapolis, Ind., or use the coupon.

Use coupon on page 93; circle No. 12-17

New Heavy A-C Diesel Tractor

Allis-Chalmers' latest torque converter tractor, the HD-20, weighs 41,000 pounds and is powered by a 2-cycle GM 6-110 diesel. In the de-



A-C diesel tractor.

sign of this tractor, particular care was taken to simplify maintenance and repair, as well as removal and replacement of major parts. Full information from Tractor Division, Allis-Chalmers Mfg. Co., Milwaukee 1, Wisc., or use the coupon.

Use coupon on page 93; circle No. 12-18

Quicker and Cheaper Rust Removal

An absolutely clean surface is essential to good service from any paint job (see PW, November, page 31). This electric chipping hammer assures a clean surface and saves many man hours of work. It is useful on bridges, water tanks, and

other exposed surfaces where painting is necessary. Information from Arnessen Electric Co., Inc., 116 Broad St., New York 4, N. Y., or use the coupon.

Use coupon on page 93; circle No. 12-19

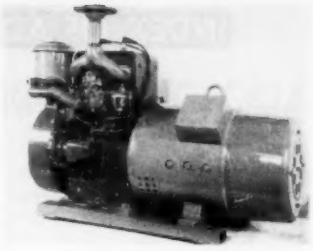
Lightweight Portable Crusher & Screener

Designed to produce low cost gravel for road maintenance and small concrete jobs, this new lightweight plant is 100% portable. There is nothing to set up or take down when transporting. Depending on local conditions, production will be 50 to 75 tons per hour. Four sizes of crushers are available, 10x16, 10x20, 10x24, and 12x16 twin jaw. Ask for Bulletin HAWK-1, Iowa Mfg. Co., Cedar Rapids, Ia., or use the coupon.

Use coupon on page 93; circle No. 12-20

Small Power and Lighting Plant

A new stand-by electric power unit has a 2-cylinder air-cooled engine, and has a rated capacity of 5 kw. Other Katolight generators are available with speeds from 1,800 to 720 rpm, in capacities from 500 watts to 300 kw, and from 25 to 400 cycles. On the unit shown herewith, no batteries are needed, unless desired. Full information from Kato Engrg. Co., Mankato, Minn., or by using the coupon.



Small power plant.

Use coupon on page 93; circle No. 12-21

For Mixing a Little Concrete

It is a lot easier to mix a small amount of concrete with this mixer than it is to do it by hand. It has a half-bag capacity. Power is by a ¾-hp aircooled motor; tilting is by a hand wheel. The mixer can be hitched and towed easily. More information from Jaeger Machine Co., Columbus 16, Ohio. Ask for Bulletin 3½ST-50, or use the coupon.

Use coupon on page 93; circle No. 12-22

PERSONAL NEWS

David B. Lee, Chief Sanitary Engineer and Director of the Bureau of Sanitary Engineering of Florida, has been elected president of the Florida Public Health Association.

Raymond J. Faust, chief of the Water Supply Section of the Michigan Department of Health, has been appointed Executive Assistant Secretary of the American Water Works Association, effective about the first of the year. Mr. Faust has been with the Michigan Department of Health since his graduation from Penn State in 1923.

American Public Works Congress

At the 56th Annual Congress, held in New York City, in October, Milton Rosen, Commissioner of Public Works of St. Paul, Minn., was elected president; Ralph Taylor, Sup't. of Waste Collection of Cincinnati and Ralph Graham, Sup't. of Construction and Public Works of Davenport, Ia., were elected directors. In addition, there were three holdover vice-presidents and two holdover board members.

INDEX OF ADVERTISEMENTS

NEED DETAILED INFORMATION?

THESE ENGINEERING CATALOGS ARE FREE

These helpful booklets are free. Just circle numbers you want on coupon and mail or write the manufacturer direct and mention PUBLIC WORKS. This service is restricted to those actually employed in public work.

NEW LISTINGS

Do You Have Data on Asbestos Yarning Rope?

87. Easily handled asbestos yarning rope will not contaminate water; packs tightly in joint to form base for all types of sealing compounds. A new bulletin describes the plain, rubber-coated and copper-jacketed styles available and provides data for determining size and amount needed for standard pipe joints. Check coupon for your copy. Johns-Manville, 22 E. 40th St., New York 16, N. Y.

How To Stop Water Hammer Damage

99. Water hammer and pipe line surges can be controlled, and damage to pumps, valves and fittings avoided by installation of "Fluidynamic Desurgers" at strategic points. These devices are available in standard pipe sizes, and may be installed in existing lines or new construction. There is no resistance to normal flow through the desurger. Full engineering information by checking coupon. Valve Equipment and Development Co., 30 Rockefeller Plaza, New York 22, N. Y.

New Soil Compaction Data And Interesting Case Histories

104. Substantial savings in soil compaction to meet rigorous foundation specs may be obtained by vibrating pneumatic-tired rollers, as shown in the actual case histories of highway and airport construction projects in the new "Compactor" bulletin. Diagrams show how additional compaction is produced by vibration. Get this interesting bulletin by checking coupon. Iowa Mfg. Co., Cedar Rapids, Iowa.

Engineering Data on Dorrco "Vacuator"

118. The "Vacuator" is a compact unit combining sedimentation, controlled vacuum flotation of scum and lighter solids, and removal of grit from sewage and industrial wastes. Major applications are as a grit and scum removal unit, as a complete primary unit, and as a sole treatment unit. High overflow rates minimize construction costs. Full design data and operating results from practice are included in attractive bulletin 6301 published by The Dorr Co., Barry Pl., Stamford, Conn. Check coupon for your copy.

Investigate These Street Lighting Standards

127. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards by using the handy coupon. Check these strong, well designed, yet inexpensive steel standards for practical street and highway lighting. Handsome folder also includes data sheets on floodlighting and area lighting standards. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

Data on Combined Aeration, Coagulation and Sedimentation

136. A unit which combines aeration, coagulation and sedimentation for treatment of either water or sewage is described in 12-page P.F.T. Bulletin 106. Diagrams show construction of the circular "Oxidator"; flow sheets suggest single or two-stage operation or use in conjunction with biological filters. Check coupon for information on this treatment process. Pacific Flush-Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Maintenance Means Many Tractor Jobs

139. Road maintenance means an unending list of jobs to be handled by tractors, either by tractor-mounted accessories or towed equipment. A new 8-page folder, "Make Maintenance Dollars Give More Mileage", tells how International crawler and wheel tractors are helping maintain city, county and state roads throughout the country. Get your copy by checking the coupon. International Harvester Co., 180 N. Michigan Ave., Chicago, Ill.

Proper Garage Ventilation Aids Equipment Maintenance

156. Cold months hamper motor maintenance in closed buildings unless proper ventilation is available. It will pay you to investigate the "National" garage ventilation systems for convenient removal of exhaust gases. Both underfloor and overhead designs are shown in detail in new bulletin. Use coupon or write to National Systems of Garage Ventilation, Inc., Dept. 16-A, 318 N. Church St., Decatur, Ill.

Precision Chemical Pump For Hypochlorination

181. Bulletin PM-11 describes the Model AP Precision chemical pump for accurate feeding of hypochlorites or other corrosive liquids used in water treatment. Applications include hypo-chlorination for swimming pools, camps, hotels and small municipal supplies where chemical feed is from 1 to 20 gallons per day. Precision Machine Co., 5 Union Sq., Somerville 43, Mass.

Hydraulic Bulldozers For Every Size Job

183. In a new bulletin "Caterpillar" hydraulic bulldozers with either straight or angle blades are fully specified for use with five different size tractors, the D2 to D8 inclusive. Be sure to check the advantages of "Caterpillar" controls and bulldozers for every type of earth moving job. Use coupon to get Form 30045. Caterpillar Tractor Co., Peoria 8, Ill.

Combination Overhead And Front-End Shovel

194. The "Lodover", described in Bulletin LO 200, is a combination overhead and front-end shovel for International T-9 and TD-9 tractors. By digging in front, swinging load overhead and dumping to the rear, extra yards are handled every hour. Regular front-end loading is not impeded in any way. Service Supply Corporation, Philadelphia 32, Pa. Check handy coupon.

Data Offered On Mixed Flow Pumps

201. Data on the complete line of Worthington Mixflo pumps of the two-vane, non-clogging sewage type is offered in 16-page bulletin W-317-H16. Salient features are outlined, typical sections, performance curves and general data for five types are included. Helpful charts aid shafting selection. Copies available by using coupon or from Worthington Pump and Machinery Corp., Harrison, N. J.

"Soda Ash" A 64-Page Manual

208. A newly published manual entitled "Soda Ash" offers the complete story of that chemical, its history, preparation, handling and uses, together with an extensive technical data section outlining the properties of soda ash and methods of analysis. Available without charge to users of soda ash by Columbia Chemical Division, Pittsburgh Plate Glass Co., 5th Ave. at Bellefield, Pittsburgh 13, Pa.

Modern Power Plants Want Diesel Economy

209. Be sure to check the Baldwin Series 600 Diesel Engine where diesel power is needed. Design features and specifications, performance curves, and ratings, which range from 430 to 1500 hp are covered in Bulletin 321. Check coupon for your copy and full details. Baldwin Locomotive Works, Philadelphia 42, Pa.

Are You Ready Now To Make Main Repairs?

214. Broken water mains can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Get Skinner Catalog 41 now—this handsome 40-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy. M. B. Skinner & Co., So. Bend 21, Ind.

MORE LISTINGS ON PAGES 94-97

Clip and Mail Today

READERS' SERVICE DEPT.
PUBLIC WORKS MAGAZINE
310 East 45th Street, New York 17, N. Y.

Please send me the following literature listed in the Reader's Service Dept. of your December issue.

Booklets from pages 93-97:

21	23	25	28	29	31	32	33	34	35	41	46	49
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New Products; Pages 87-90:

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12-21	12-22								

Name .....

Occupation .....

Street .....

City ..... **State** .....

THIS COUPON NOT GOOD AFTER JANUARY 31, 1951

Portable Steam Boiler Thaws Culverts; Heats Tank Cars

185. The Bros Portable Steam Boiler generates hot, dry steam in 20 minutes from a cold start for thawing culverts and catch basins or heating tank cars for removal of asphalt and tar. Scotch marine type units are available in trailer, skid and truck mountings. Detailed product data sheet gives full information. Use coupon or write Wm. Bros Boiler & Mfg. Co., 1057 10th Ave., S. E., Minneapolis 14, Minn.

SNOW FIGHTING

How to Select the Proper Sno-Plow for Your Truck

21. Fully illustrated 24-page catalog on Frink Sno-Plows includes valuable tables on proper plow and leveling wing selection for mounting on all size trucks. Detailed discussions cover special features which result in performance plus economy. Use coupon for copy. Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

Spreaders for Ice Control Save Labor and Speed Job

28. Only the driver is needed to spread salt or abrasives for ice control when a Flink Tail-Gate Spreader is used. Hydraulically driven, fully automatic unit is controlled from the cab. Further details in bulletin issued by The Flink Co., Dept 11-S, Streator, Ill. Use coupon today.

How to Keep Your Loader On the Job

50. Don't take more time to move your loader to the job than to do the work. Investigate the Eagle Truck Mounted Loader for handling gravel, sand, cinders, snow from windrows or piles. Get forms 444 and 947 from Eagle Crusher Co., Inc., Galion, Ohio.

Chemical Stops Salt Corrosion

174. A new chemical has been developed which, when mixed 1 pound to 100 pounds of salt, prevents any corrosion of automobiles by the salt. Harmless; colorless; odorless. Permits free use of salt for ice and snow control without complaint by drivers. Calgon, Inc., Pittsburgh, Pa.

Two-Way FM Radio Telephone Equipment for All Departments

197. The benefits of two-way radio communication for all departments of municipalities and counties make full information on this subject important to all engineers. For descriptions of Motorola FM systems, or for specific recommendations concerning your application write to Dept. PW, Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.

Full Line of Plows Meets All Snow Removal Needs

242. Data issued by the Gledhill Co. covers the 22 standard snow plows available to meet all snow removal needs. Safety trip, foldback hoist and interchangeability are featured. Write Gledhill Road Machinery Co., Galion, Ohio, or use coupon.

Thrifty Salt Spreader for Snow and Ice Control

248. Check to Tarco "Scotchman" for fast, thrifty salt application to icy roads. Stainless steel spreader has weatherproofed engine. Get all data from Tarrant Mfg. Co., Jumel St., Saratoga Springs, N. Y.

POWER AND LIGHT

Air Cooled Engines for Hundreds of Applications

137. Tested under severest conditions of long, hard use, these engines have earned world wide recognition as the "right" power for hundreds of applications. Get latest bulletin from Dept. PW, Briggs and Stratton Corp., Milwaukee 1, Wisc.

Superior Features for Municipal Power Plants

168. Optional use of by-product gases, such as sewage sludge gas, stamina and precision construction, fuel economy and conservative rating are some of the noteworthy features of Superior Diesel Engines, described in Bulletin 4812. For a copy write The National Supply Co., Superior Engine Div., Toledo, Ohio.

CONSTRUCTION EQUIPMENT

Handbook of Contractors Pumps Is Easy to Use

49. Big 50-page Catalog P-10 covers dewatering pumps, pressure pumps, well points systems and electric pumps, and also features a special section of useful data which helps in the selection of the right pump for your job. Every construction engineer and contractor should have a copy of this valuable handbook. Just check the coupon. The Jaeger Machine Co., Dept. PW, Columbus 16, Ohio.

Handy Catalog Covers Complete Tractor and Grader Line

70. A new 20-page booklet in a handy pocket size features Allis-Chalmers complete industrial tractor line. The importance of wise buying and fitting the equipment to the job is emphasized. Don't miss your copy. Use coupon today. Allis-Chalmers Mfg. Co., Tractor Div., Box 512, Milwaukee, Wis.

Drill Concrete With Your Ordinary Electric Drill

82. Substantial cost-per-hole savings are claimed for Tilden Rotary Drills which penetrate concrete 2" to 4" per minute. Cutters can be resharpened. Available in sizes ¼" to 4". Get full data from Tilden Tool Mfg. Co., 1995 N. Fair Oaks Ave., Pasadena 3, Calif.

Lightweight Pump Ready to Handle Large Volume

93. To find out how well a Homelite Carryable Pump handles large volume, seepage, mud, write today for illustrated bulletin L-503 containing data of great value to all pump users. Write Dept. PW, Homelite Corp., 2111 Riverdale Ave., Port Chester, N. Y.

Grading Can Be Faster, Cheaper and Easier

96. You'll like every feature of the Austin-Western 99H Grader. It has all-wheel drive, all-wheel steer, controlled traction, precision sideshift and a high lift, extreme reach, reversible blade. Get data from Austin-Western Co., Aurora, Ill.

International Trucks Are Built to Take It

120. Trucks take a pounding in construction work—that's why you need data on International Trucks that are engineered for your job. Check the coupon or write International Trucks, Dept. PW, 180 N. Michigan Ave., Chicago 1, Ill.

Mack Trucks for Every Road Building Job

184. An illustrated bulletin entitled "Mack Builds the Highways of the Future" tells the story of Mack trucks on the heavy work of highway building and shows how Mack design meets the extra demands of this use. Copies available from Mack Mfg. Corp., Empire State Building, New York 1, N. Y.

Helpful "How To Use" Section Aids Roller Selection

195. In addition to specification and illustrations of roller operation, the new Buffalo-Springfield catalog features a special section to help in the selection of the right roller model for the job. Be sure you get top results from your roller selection by checking this helpful material. Use the coupon for a copy. Buffalo-Springfield Roller Co., Springfield, Ohio.

Self-Priming Trash Pumps Work "High and Dry"

205. The maintenance difficulties of submerged trash pumps is avoided in the new non-clogging, self-priming trash type sump pumps described and illustrated in Form 9-ST-11, issued by The Gorman-Rupp Co., Mansfield, Ohio. Performance curves and specifications are included.

High-Speed Scraper Engineered for Performance

212. A handsome new bulletin just issued by Heil Company shows how the powerful Heiliner is engineered for performance in earth moving and road building jobs. 20-yd. bottom dump wagon and 18 yd. scraper are interchangeable when used with the Heiliner tractor. Check coupon for copy of this bulletin. The Heil Co., Milwaukee 1, Wisc.

STREETS AND HIGHWAYS

How the Mobil-Sweeper Can Improve Street Sweeping

23. Sweeping costs can be cut with the new Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 10, Wis.

Get Data Now On This Catch Basin Cleaner

34. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass.

Do You Have Complete Black Top Equipment Data?

41. In 36-page catalog AA a full line of equipment for black top road construction and maintenance is covered. Units described and illustrated include several models of pressure distributors, supply tanks, sprayers, brooms, asphalt kettles, portable rollers, and accessory tools. Use coupon for copy of this handy manual. Littleford Bros., 452 E. Pearl St., Cincinnati 2, Ohio.

Municipalities Make Equipment Dollars Go Further

55. Be sure to get your copy of "Saving Facts" a new illustrated booklet prepared by The Oliver Corp. that shows how equipment dollars can be stretched on municipal work. Text and photos describe the application of tractors and money-saving attachments in street maintenance, snow removal, waste disposal, pipe laying and other projects. Write The Oliver Corp., Industrial Div., 19300 Euclid Ave., Cleveland 17, Ohio.

Reference Manual on Guardrail Design

114. Here is an interesting and informative booklet in which all factors influencing guardrail design are outlined, and safety and economy discussed in detail. Eight pages are devoted to basic design data, with handy tables covering physical properties, tensile and beam strengths, deflection and other data. Write Armco Drainage and Metal Products, Inc., Dept. PW, Middletown, Ohio.

Versatile Maintainer Has Year 'Round Usefulness

151. A new bulletin shows how the sturdy Huber Maintainer will work for you the year 'round on maintenance jobs, berm leveling, road planing, bull-dozing, snow plowing, brooming, mowing shoulders and as a patch roller. Good ideas on how to do all these jobs in Bulletin No. M-138. Write Huber Manufacturing Co., Dept. PW, Marion, Ohio.

Useful Data for Highway Builders In Barrett Road Book

190. The latest edition of "The Barrett Road Book" has 54 pages of helpful tables and step-by-step outlines of highway maintenance and construction with Tarvia and Tarvia-lithic. Tables show quantities per yard and mile; aggregate gradings; costs; many others. Get this useful book from Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

Investigate "Package" Bridges To Speed Construction and Save Money

219. Three basic elements of precast reinforced concrete—cribbing, bridge seat and bridge deck slabs—are combined for construction of bridges up to 40' span. Details of the units, and a construction story in step-by-step pictures are contained in the new PB-50 Bulletin issued by Universal Concrete Pipe Co., Columbus 15, Ohio. The handy coupon will get your copy quickly.

Road Widening With Concrete, Bituminous Mix or Gravel

149. All types of road building materials are handled quickly and accurately by Apsco Wideners. New illustrated bulletin shows operations on all types of widening strips, gives details on wideners and trench rollers. Issued by All Purpose Spreader Co., Elyria, Ohio.

The Easier Way For Pavement Breaking

220. Rapid Pavement breaking the low cost way is described in bulletins issued by the R.P.B. Corp., 2751 East 11th St., Los Angeles, Calif. Both "Mighty Midget" and heavy-duty truck-mounted models make quick, clean cuts, break trench openings or tamp backfill. Use coupon for full data.

REFUSE COLLECTION AND DISPOSAL

How to Lower Costs Of Refuse Collection

35. For saving trucks, labor and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Bros., Inc., 980 Dempster Bldg., Knoxville 17, Tenn.

An Incinerator Necessity

215. Recuperators featuring individual replacement of the heat transfer elements (silicon carbide tubes) for maximum accessibility and efficiency are described and illustrated in Bulletin 14 issued by Fitch Recuperator Co., Dept. PW, Plainfield Nat'l Bank Bldg., Plainfield, N. J.

WATER WORKS

Makes Underground Pipe Installations Easy

25. One-man operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117, Greenlee Tool Co., Dept. PW, 2048 Twelfth St., Rockford, Ill.

The Modern, Streamlined Elevated Tank

32. A new 8-page bulletin describes the Watersphere, a modern elevated water tank of welded steel construction for general service gravity water pressure and fire protection. Construction details, illustrations of typical installations and table of standard sizes from 25,000 to 250,000 gallons capacity are included. Check the coupon. Chicago Bridge & Iron Co., 2115 McCormick Bldg., Chicago 4, Ill.

Is Your City Metered 100%?

33. 100% metering as practiced by many cities requires accurate, dependable meters with interchangeable parts. Cut-away views of every part, capacity and size data are all included in handsome American-Niagara water meter booklet available from Buffalo Meter Co., 2920 Main St., Buffalo 14, N. Y.

Cast Iron Pipe and Fittings For Every Need

65. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Dept. PW, Burlington, N. J.

96 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. A 96 page booklet. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

How to Make Fluoride Determinations

235. Information on the Hellige Aqua Tester for precise fluoridation control in the range from 0 to 1.6 ppm fluoride is available from Hellige, Inc., 3718 Northern Blvd., Long Island City 1, N. Y., by using coupon.

All Electric Floatless Liquid Level Control

78. Description of operating principles and applications of B/W controls shows the simplicity and many uses of these all-electric, floatless devices. Diagrams of typical installations and engineering data all in bulletin 147 issued by B/W Controller Corp., Dept. PW, Birmingham, Mich.

Speedier, Space-Saving Purification Apparatus

81. A new 12-page bulletin, No. 2204, tells how the Spaulding Precipitator, in removing impurities from a liquid by precipitation, adsorption, settling, and upward filtration, occupies less space, uses less chemicals and speeds up treatment. Permutit Co., 330 West 42nd St., New York 18, N. Y.

Full Data on Automatic Filter Controls

103. Automatic Filter Operation. The Robotrol automatically back washes, rewashes and returns the filter to service. Illustrated Engineering Bulletin 1230. Infilco Inc., P.O. Box 5033, Tucson, Ariz.

Well Water Systems Built to Last

105. Layne pumps are built for wells ranging from 4" to 36" diameter and in capacities from 50 to 16,000 gpm. Full engineering data and many installation views are given in 32 page Pump Bulletin 4-42. Layne and Bowler, Inc., Memphis, Tenn.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

How to Tap Concrete Pressure Pipe

126. The simple steps required in making a pressure tap in concrete pressure pipe are explained in a booklet issued by Lock Joint Pipe Company. Be sure you know how either large connections or small service outlets may be made economically and without sacrifice of strength. Just check the handy coupon. Lock Joint Pipe Co., Box 269, East Orange, N. J.

Data on Chlorinizer Now Available

132. Bulletin 840-F2 features the Builders Chlorinizer and shows complete details of apparatus to accurately meter chlorine gas and deliver controlled chlorine-water solution. Positive rate of flow indication, wide metering range. Get your copy of this bulletin from Builders-Providence, Inc., P. O. Box 1342, Providence 1, R. I.

All About Cement-Mortar Lining of Water Mains

133. Here, in a really beautiful booklet, is practically everything you need to know about this method of lining mains in place—the needs, methods, and results that will interest you. Centriline Corp., Dept. PW, 140 Cedar St., New York 6, N. Y.

Helpful Data on Mechanical Joints

138. Get Circular 49 from M & H Valve & Fittings Co. for important information and installation dimensions of M & H AWWA Mechanical Joint Valves and Hydrants. Features include ease of installation, construction economy, long life. Use coupon or write M & H Valve & Fittings Co., Anniston, Ala.

Helpful Data on Corporation Stops

161. A complete line of brass goods for water works: corporation stops, curb stops, service pipe couplings, goosenecks and other fittings are illustrated and described in catalog W-39, issued by A. Y. McDonald Mfg. Co., Dubuque, Iowa. Get your copy for ready reference.

What You Should Know About Meter Setting and Testing Equipment

166. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All waterworks men concerned with setting and testing of water meters should have a copy of this book. Write for Catalog No. 50.

Handy Calculator for Cast Iron Pipe

175. With the handy Cast Iron Pipe Calculator you can determine at a glance the class, weight and dimensions of bell and spigot pipe. This slide-rule type calculator is absolutely free. Use coupon or write R. D. Wood Company, Public Ledger Bldg., Philadelphia 5, Pa.

Locate Mains and Services Without Digging

186. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes and valves by electronic means. Proper manipulation also determines depth of cover. Battery operated unit is readily carried by one man. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.

Chlorination for Large and Small Pools

210. Dependable chlorination is a necessity for all swimming pools, no matter how large or small. You can find out just how to protect your pool in the most dependable and economical way by using the coupon or writing Wallace & Tiernan Co., Inc., Box 178, Newark 1, N. J.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., Clinton, Iowa.

Investigate This Compact Flow Meter for Water

226. The Foster "Flow Tube" is a new metering element that is compact and easy to install. Bulletin FT illustrates simple element containing nozzles for differential pressure production and shows capacity range and accuracy. Made in standard type sizes. Foster Engineering Co., Union, N. J. will send copy, or use coupon.

Helpful Data on Main Sterilization

231. This detailed discussion of main and emergency sterilization indicates standard procedure, shows how to calculate quantities of sterilizing solution, describes equipment and gives typical specifications. All calculations can be solved by use of a simple chart. Use coupon to get your copy of Bulletin SM-9365. Proportioneers, Inc., P. O. Box 1442, Providence 1, R. I.

SEWERAGE AND WASTE TREATMENT

Water Level Controls for Sewage and Water Plants

31. Dependable float-operated pump and motorized valve controls for single or multiple pump installations are described in bulletins issued by the Water Level Controls Div., Healy-Ruff Co., 719 Hampden Ave., St. Paul 4, Minn. All units feature splash proof construction, mercury tube switches.

A Handbook of Sewer Cleaning Equipment and Methods

46. A new, fully illustrated 40-page booklet shows every sewer cleaning operation with "Flexible" tools. Includes data on the fast and easily operated new Sewe RodeR and full engineers' specifications for power bucket machines. For your copy write Flexible Sewer Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.

How You Can Dispose Of Sewage Solids

54. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Dept. PW, Nichols Engineering and Research Corp., 70 Pine St., New York 5, N. Y.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use coupon or write Jeffrey Mfg. Co., Columbus 16, Ohio.

Glazed Clay Blocks for Trickling Filter Underdrains

66. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., 327 Fifth Ave., Pittsburgh 22, Pa., for free copy.

Standard Forms for Concrete Pipe

67. Concrete pipe for sewerage, drainage and culvert projects can be produced quickly and uniformly with Quinn Standard concrete forms. Data on forms for 12" to 84" tongue and groove or bell end reinforced pipe from Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

Recording Meters for Parabolic Flumes

73. Engineering data on parabolic flumes and accurate companion meters for open flow water and sewage metering is given in Simplex bulletin 210. Installation data and calibration included. Write Simplex Valve and Meter Co. Dept. 4, 6750 Upland St., Philadelphia 42, Pa.

Vitrified, Salt Glazed Filter Bed Block

86. An 8-page folder contains instructive design applications and detailed descriptions of Dickey underdrain tile for filter bed bottoms. Diagrams show how air passes up through blocks for filter ventilation. Issued by W. S. Dickey Clay Mfg. Co., 922 Walnut St., Kansas City 6, Mo.

How Cities Can Do Complete Sewer Cleaning From Street

98. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Power machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation. 4752 Sheffield Avenue, Hammond, Indiana

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves is contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., 200 Eliot Street, Fairfield, Conn

How to Improve Coagulation and Sludge Conditioning

111. "Ferri-Floc," description and instructions for use in coagulation, sludge conditioning and treating industrial wastes, fully treated in a 24-page pamphlet. Tennessee Corp., 619-27 Grant Bldg., Atlanta 1, Ga.

Need Low-Cost Air For Sewage Treatment?

122. New 20-page booklet shows operating and construction features of Rotary Positive Blowers engineered to fit your needs. Air for activated sludge, water treatment; constant vacuum for filtering. Bulletin 22-23-B-13 gives details. Roots-Connersville Blower Corp., 511 Poplar Ave., Connersville, Ind.

Comminutors for Automatic Disposal of Coarse Sewage Solids

152. The problems connected with disposal of coarse sewage solids are eliminated by clean, odorless, automatic Comminutors. Full engineering data show the proper model for every size plant and furnish details of hydraulics and typical installations. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

Check "Gunite" Concrete For Every Application

158. Big 44-page book illustrates "Gunite" uses for both repair and new construction of sewers, tanks, dams, swimming pools, and all concrete structures. A multitude of applications. Be sure to check coupon or write Pressure Concrete Co., Dept. PW, 315 S. Court St., Florence, Ala.

Fabrication with Everdur For Long-Range Economy

169. Corrosion-resistant Everdur alloys are available in all wrought commercial shapes suited for dozens of applications in water and sewage plants. Many examples shown in Publication E-11 issued by The American Brass Co., Waterbury 20, Conn.

Conkey Filters for Sewage Sludge Disposal

180. Development of Conkey sludge filters and applications to all types of sewage sludge are described in Bulletin 100. Tables show filter sizes, weights, and give average anticipated results. Write General American Transportation Corp., Process Equip. Div., 10 East 49th St., New York 17, N. Y.

Eight Advantages of Vacuum Sludge Dewatering

189. Efficient sewage treatment requires economical sludge disposal. Eight advantages of vacuum dewatering of sewage sludge are described in a new folder issued by the Eimco Corp., Salt Lake City 8, Utah. Use the coupon for your free copy.

Data on Design of Grit Collectors and Washers

202. Grit collection and separation of organic materials from settled grit is described in Link-Belt Bulletin 1942. Typical installations are shown, and design data is provided, together with specifications. Use coupon for copy, or write Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

Vacuum Filter Design Data

225. Typical flow diagrams, details of operation, power requirements and standard sizes of individual units and "package" units of the Oliver Sewage Sludge Dewaterer are presented in Bulletin 219. Check coupon for your copy. Oliver United Filters, Inc., 33 W. 42nd St., New York, N. Y.

How to Estimate Quantity Of Joint Compound Needed

229. Directions for using Atlas G-K Sewer Joint Compound plus a handy table quantity of compound and jute required per joint of sewer pipe are presented in Bulletin M20-1. Get full data on this permanent joint material from Atlas Mineral Products Co., 10 Pine St., Mertztown, Pa., or use coupon.

WORTH TELLING . . .

by Arthur K. Akers

● Sweeping the nation, as it were, **Ted Lassen** and **Harry Burgdorff** of the **Conveyor Company** hung up a new kind of transcontinental record this fall when they drove a Conveyor street sweeper from Los Angeles headquarters to the A. P. W. A. Congress in New York. Rugged men as well as machines, say we!

● One of the most beautiful brochures we have ever seen describes the 20800 Heiliner. Get your copy from **The Heil Company**, Milwaukee 1.

● **Porcelain Metal Products Company**, of Carnegie, Pa., has been sold. New officials and part owners are **T. O. Warfield**, Lima, Ohio, president; **J. R. Sweeney**, Alliance, Ohio, vice president, sales.

● After long years in New York City, **Central Foundry Company** has moved its general offices to Murray and Pacific Streets, Newark 5, N. J.

Mr. Jones

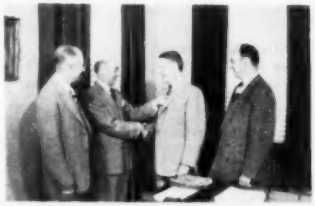
● **Bertram V. Jones** has been appointed advertising manager of **Link-Belt Company**, Chicago, succeeding **Julius S. Holl**, deceased. **John F. Kelly** continues as assistant advertising manager.

● **Fred C. Foy**, former head of sales, Tar Products Division of **Koppers Company**, Pittsburgh, has been elected vice president and general manager, same division.

● **Harold C. Clark** as eastern district sales representative now supervises sales in 18 states for **The Buffalo-Springfield Roller Company** from headquarters in Harrisburg, Pa.

● **C. W. Nichols Sr.**, chairman of the board of **Nichols Engineering and Research Corporation**, New York, informed the American Public Works Congress in New York October 18th of his perpetual gift to be used in giving annual recognition to the outstanding public works men in the nation. First award will be in 1951.

● Climaxing 35 years of service that began as a clerk in the engineering office, we see below **C. L. Best**, chairman of the board of **Caterpillar Tractor Company**, pinning that service pin on **President Louis B. Neumiller.**



Mr. Brown, Mr. Best, Mr. Neumiller and Mr. Eberhard

● Another new vice president is **Austin C. Ross**, of **Worthington Pump and Machinery Corporation.** He will continue to manage the Buffalo works as well.

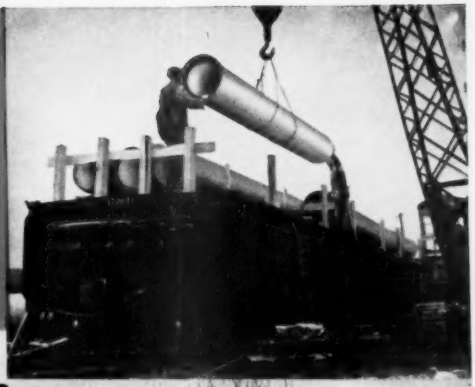
● **Wolverine Tube Division** announces appointment of **Buel A. Devine** as commodity sales manager in charge of tube sales to wholesalers and jobbers.

● **H. Gottwald** is appointed assistant vice president of **Rockwell Manufacturing Company's** meter and valve division, Pittsburgh 8. **Wm. A. Marsteller** has resigned as vice-president of the same company's 14 divisions, to establish The Marsteller Company, consultants in marketing and advertising, at 612 North Michigan Avenue, Chicago 11, after Jan. 1, 1951. As tenants in the same building, our Chicago office welcomes Mr. Marsteller to the neighborhood!

● **The Osgood Company** and the **General Excavator Company**, Marion, Ohio, announce the combination of their sales and management offices and policies. **L. O. McLean** has been appointed director of sales development; **James S. Fortiner**, sales manager.

● **Lyman H. Allen Jr.**, has been named chief engineer of **Foster D. Snell, Inc.**, New York 11.

16" *and* UP



If your requirements call for transmission or distribution mains of 16" diameter or larger, Lock Joint Pipe Company can provide high quality concrete pressure pipe in all standard diameters and some intermediate sizes. Starting at a minimum of 16", Lock Joint Concrete Pressure Pipe is produced in 32 different diameters, and its four distinct types of structural design cover every working condition common to American water works practice.

Not only does Lock Joint Concrete Pressure Pipe qualify fully under A.W.W.A. specifications, but it alone embodies, in a conventionally designed pipe priced to meet competition, all the nine time-tested characteristics listed at right:

- **PERMANENT HIGH CARRYING CAPACITY**
- **PROOF AGAINST TUBERCULATION, CORROSION AND ELECTROLYTIC DAMAGE**
- **IMMUNITY TO RUPTURE OR BLOW-OUT**
- **SAFETY UNDER EXTREME EXTERNAL LOADS**
- **EVERY JOINT FLEXIBLE AND WATERTIGHT**
- **EASILY TAPPED**
- **SPECIALS TO MEET INDIVIDUAL SPECIFICATIONS**
- **USEFUL LIFE CONSERVATIVELY ESTIMATED AT 100 YEARS**
- **MINIMUM MAINTENANCE AND REPAIR COSTS**

Whether your proposed line is large or small it will pay you to use Lock Joint Concrete Pressure Pipe, the pipe of proven durability, economy and dependability.

SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

LOCK JOINT PIPE COMPANY

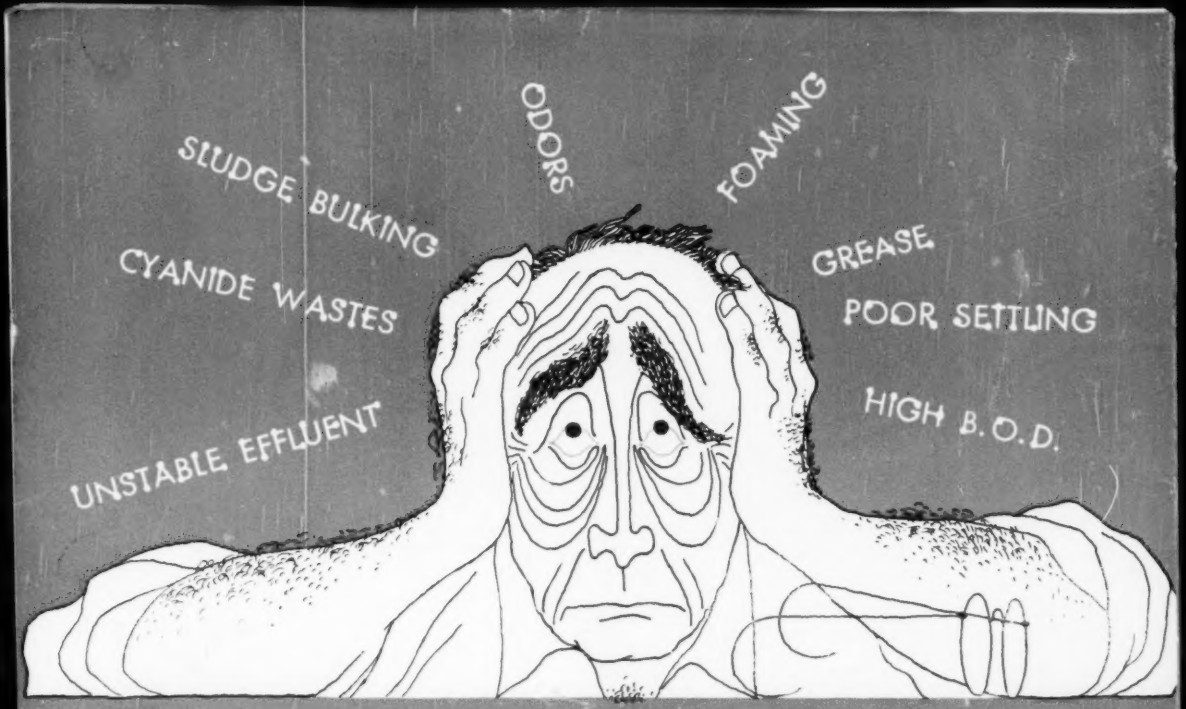
Est. 1905

P.O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich.

BRANCH OFFICES: Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. Kansas City, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. Oklahoma City, Okla. • Tulsa, Okla.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE



HEADACHES YOU CAN AVOID

with CHLORINATION by Wallace & Tiernan

Chlorination—the modern aid to sewage treatment—has proven its ability to overcome many sewage treatment "headaches" in hundreds of plants all over the country.

To mention only a few—chlorination *controls odors* at Fort Wayne, Indiana; *reduces filter ponding* at Rotterdam, New York; and *sterilizes the effluent* of the Easterly Sewage Plant in Cleveland, Ohio.

Results? Here's a typical statement from Mr. Ralph Hoot, Superintendent at Fort Wayne. "***We have been most thankful for our automatic chlorine control equipment. It has done its job well."

Chlorination engineered by Wallace & Tiernan can help *your* plant, too. Best of all the cost generally averages less than 1% of initial plant investment. This low cost, coupled with the savings and increased plant efficiency made possible by effective chlorination, makes it a buy dollar-wise purchasers can't afford to overlook.

Put this modern aid to sewage treatment to work in *your* plant. A call to your nearest Wallace & Tiernan Representative brings all the details.

8-57

WALLACE & TIERNAN
COMPANY, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES